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THE AMERICAN GAS LIGHT JOURNAL

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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Annual Meeting, Western Gas Association..... 521

EDITORIALS—
Briefly Told..... 521
The Louisville Meeting—The World's Fair and the Gas Interest—Society of Gas Lighting—In Memorium Resolutions.
The Market for Gas Securities..... 522
Seventh Annual Meeting of the Ohio Gas Light Association—Official Report—Revised by the Secretary—Concluded from page 495 522
Second Day, Morning Session—Report of Committee on Nominations—Delegate to the World's Fair—The Present Outlook for Manufactured Fuel Gas, by George H. Christian—Discussion—Second Day, Afternoon Session—Election of Officers—Question Box—"Given a Town of 10,000 Population, Output of Gas 8,000,000, 250 Meters, 5 Miles of Mains, Selling Coal Gas at $2 per 1,000 net, Cost of Coal $3.25, with Street Lighting Done by a Municipal Plant: Can an Electric Plant be Operated Successfully in Opposition, Using Steam Power?"—"Suppose the Normal Pressure, etc.," a Problem in Pressure Conditions—"Has Illuminating Gas Been Improved and Cheapened During the Past Three Years as Much as Has the Incandescent Electric Light?"—"What is the Best Method of Burning Carbon from Retorts?"—"What is the Best Method of Repairing Leaky Gasholder Tanks?"—"Would it be Economy for a Gas Company With Only 1,500 Consumers to do its own Meter Repairing?"—"What is the Igniting Temperature of Common Coal Gas?"—What is the Least Grade per 100 Lineal Feet Practicable to Drain Gas Mains?"—"When a Mixture of Coal Gas and Air is Exploded, How Much Does the Volume of the Resultant Gases Exceed that of the Original Mixture?"—"Is there any Steam Heating Apparatus in which Illuminating Gas Can Be Used for Fuel at Not Too Great a Cost, When Gas Is Figured at Cost in the Holders?"—"What is the Average Per Cent. of Sulphur in Lima Crude Oil, etc."—"What are the Causes of the Lowering of the Candle Power of Gas, etc?"—"What is Best Material for Roof of Retort House etc?"—"What is the Cause of Lava Tips Fouling When the Gas Shows Clean by the Usual Test?"—Votes of Thanks—Adjourned.
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 531
Hints from Alton, Ills.—Doings at Riverside, Cal.—The Carondelet Company to Supply Incandescent Electric Light—To Sue the Wheeling (W. Va.) Authorities—Dividend Increased—Mr. Burnham Goes to Boston—The Singer Company to Buy Its Gas—Sale of the Saco Plant—The Decision of the Commissioners in the Easthampton, Mass., Case—Long Hours—No General Bill is Likely to Pass—Mr. Whittier's Contracts—Mr. E. C. Jones Goes to San Francisco—Director Wagner's Successor—Gas for Cooking, Dallas, Texas—Capital Stock to be Increased—Report of Phila. Gas Bureau, First Quarter, 1891—More Injunction Proceedings—How Mr. Todd Overcame Back Pressure—Natural Gas Rates Increased, Columbus, Ohio—Dispute Over Gas Tar Contracts, Phila., Pa.—And Many Other Items.

[OFFICIAL NOTICE.]

Annual Meeting, Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., April 6th, 1891.

The Fourteenth Annual Meeting of the Western Gas Association will be held at Louisville, Ky., on the 20th, 21st and 22d days of May. The Galt House has been chosen as the Association's headquarters, and the business sessions of the convention will also be held therein. Rates for members in attendance will be announced in subsequent issues of the JOURNAL.

Following the usual custom in such matters, I again try to impress upon our members the importance of engaging their rooms in advance of the date of the meeting. While the Galt House is a strictly first-class hotel, as well as one of fairly generous proportions, yet its resources will be severely taxed during the above named dates in May, for the reason that delegates to another convention than ours will also be assembled within its walls, and unless our members exercise the forethought to secure their accommodations in the manner above stated, it may be a matter of regret with some later on that they failed to pay due heed to these well-intended suggestions of their Secretary. Communications on this subject may be addressed to Mr. A. H. Barret, Engineer of the Louisville Gas Company, who, in his capacity of Chairman of the Local Committee of Arrangements, will take pleasure in doing his best to make proper provision for all who can be present.

As this is the first time in the history of the Western Gas Association that its members, in convention assembled, have met on Southern soil, it is especially desired that a full attendance from the Sunny South may grace the occasion by their presence. A cordial invitation is, therefore, extended to every gas man south of the Ohio river (and an equally cordial one to those north, east and west of it as well), and may the absentees be noted by the paucity of their number.

Copies of the By-Laws, containing the membership list of the Association, will have been mailed to our members before this notice appears in print. To those desirous of joining our Association at the Louisville meeting, copies will be sent upon application to the undersigned. A perusal of the By-Laws will inform the applicant of the steps which must be taken to attain membership in an Association to which he should feel it a pleasure as well as a duty to belong. A. W. LITTLETON, Sec'y.

BRIEFLY TOLD.

THE LOUISVILLE MEETING.—In our current issue Secretary Littleton holds out to the fraternity the first official intimation that the Western Association is actively at work, through its President, Secretary and Committees, preparing for the Louisville meeting, now but a few weeks ahead of us. With his accustomed shrewdness, Secretary Littleton shows wherein it would be more than ever the part of wisdom to secure one's quarters at the Galt House well in advance; for although that celebrated hostelry is an excellent one, both in respect to the number of its rooms and the nature of their accommodations, it has its limits as far as the number of rooms is concerned. Another convention in the city at the same time that the Western is to meet, and that has also selected

the Galt House for a stopping place, ought to make it perfectly plain why application for rooms should be made as soon as possible. It may be taken for granted, owing to the intimate knowledge possessed by Engineer A. H. Barret, of the Louisville Gas Company—the gentleman is also chairman of the local committee of arrangements—of the likes and dislikes of a great many of the delegates, together with his complete understanding of the way in which the Galt is operated, that if he is only warned in time the visitors will have no cause for striving to reach the clerk's desk first. Another good point is that headquarters and convention rooms are to be under one roof. The skeleton programme so far arranged makes it certain that the meeting in the beautiful Falls City will be a truly memorable and enjoyable one. Egner, Littleton, Barret and their aides are working like beavers, and the definite result of their labors will, from time to time, be fully put out in succeeding official notices in these columns.

THE WORLD'S FAIR AND THE GAS INTERESTS.—The determination of the Ohio Association to act in thorough harmony with the other Associations, in respect to uniformity of action in the matter of the committee to work up the gas exhibit at the coming World's Fair in Chicago, is most commendable, and its choice of a representative on the committee cannot be too highly indorsed. With such unanimity it is out of the question to look for other than a most successful issue to their efforts, and with the close of the Western meeting we may expect the promulgation of a plan of campaign. In the meantime, would it not be well were these other influential Associations—the Society of Gas Lighting and the Guild of Gas Managers—to manifest some sign of active co-operation in this affair. The gas exhibit at the Colombian Fair must be a success, and a grand one. And that would seem to call for perfect union. Possibly the Society and the Guild prefer that an invitation should be extended them before making plain their own wishes in the matter, putting such preference on the belief that they who would follow should be signalled by the leaders. In any event there ought to be no shirking in this affair. It is not Associations nor Societies that are to be on display; the industry that each seeks in its own good way to foster is to occupy the platform, and the serviceable and handsome dressing thereof is that which the fraternity as a whole most heartily desires.

SOCIETY OF GAS LIGHTING—IN MEMORIAM RESOLUTIONS.—We are indebted to Colonel Fred. S. Benson, Secretary of the Society of Gas Lighting, for the following copy of resolutions submitted by the Committee to prepare a memorial to the late William Mooney on behalf of the Society:

Whereas, At a regular meeting of the Society of Gas Lighting, held at Newark, N. J., in February, the sad intelligence was received of the death of our fellow-member, Mr. William Mooney, which occurred suddenly, at Peoria, Ills., on the 20th of January, 1891, it is hereby

Resolved, That the Society of Gas Lighting, in the death of Mr. Mooney, has lost a valuable and conscientious member, and one whose genial character and generous disposition will keep his memory forever in affectionate remembrance by his fellow-members:

Resolved, That a copy of these resolutions be furnished the AMERICAN GAS LIGHT JOURNAL for publication, that a copy be sent to the family of the deceased, and that they be spread in full on the minutes of the Society. [Signed.] EUGENE VANDERPOOL, FRED. S. BENSON, A. M. SMITH, } Committee.

The Market for Gas Securieties.

During the week Consolidated gas, in common with the general city market, moved up with some vim, some sales having been made at a trifle over 99. To-day (Friday) the opening price was 98¾–99, and buyers were more plentiful than sellers. It is still a purchase, for investment. Other city shares were in demand, particularly Equitable. We note a sale at auction of 20 shares Standard preferred, at 85. Brooklyn shares show no marked change. In the general list Chicago gas was the feature, selling at one time close to 50, but afterwards going off to 47 and a fraction—the opening to-day being made at 47⅞.

At the meeting in Chicago yesterday it was resolved to dissolve the present Trust and surrender the various properties to the original Companies. The financial agent in Philadelphia, however, will issue receipts for shares at present outstanding. The whole thing will be speedily adjusted, and we have no hesitation in saying that the receipts ought to sell at 60. Bay State is up to 63, with fair prospects for a further rise. Poughkeepsie (N. Y.) gas is bid for at 35. Cincinnati Company will increase its capital to $7,000,000.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—CONCLUDED FROM PAGE 495.]

SEVENTH ANNUAL MEETING OF THE OHIO GAS LIGHT ASSOCIATION.

HELD AT ZANESVILLE, MARCH 18 AND 19, 1891.

SECOND DAY—MORNING SESSION.

REPORT OF COMMITTEE ON NOMINATIONS

The Committee on Nominations submitted the following list of candidates:

For President—Herman Wilkiemeyer and W. W. Cantine.
For Vice-President—C. H. Welch and J. W. R. Cline.
For Secretary—Irvin Butterworth and George Light.
For Treasurer—George H. Tayler and Jerome Penn.

The President—The election of officers will take place at the afternoon session. From the report of the committee on President's address this morning, it was declared to be the sense of the Association that a committee be appointed to serve as a committee from this Association in the general committee on the World's Fair. As Mr. Harbison is chairman of the committee from the American Association, and is thoroughly familiar with the general plan laid out by the other Associations, I will ask him to address the Association on that subject.

Mr. Harbison—The subject of the World's Fair and of the gas industries in connection with the World's Fair exhibit, is, I think, quite an important one, as there will be at that fair, undoubtedly, the very best exhibition that can be gotten up by the various industries of the country. The industry in which we are engaged is, I think, second to none other in importance in this country. The amount of capital invested in the business in which we are engaged is very large. The number of companies interested and actively at work in supplying light, and, of recent years, in supplying heat and power, is growing, and their volume of business is very largely increasing. I am of the opinion that the future prosperity of the gas industry will be due as largely to the supply of gas for domestic and manufacturing purposes as for lighting, and perhaps a great deal more so. The intelligence that is at work in our industry is second to none. I think, therefore, it is due to ourselves that we should make such an exhibit at the World's Fair of what we have in connection with our profession as will boom our business all over this country. In thinking over this subject for the last two years, and in consultation with others of our profession, this subject of having an exhibit in connection with the gas industry has come up prominently, and those of us who have talked most about it have come to the conclusion—and have acted upon it—that a committee should be appointed to represent the various Associations in the country, and that that committee should not be too large in numbers and therefore ineffective, but that gentlemen might be appointed as members of the committee by the various Associations who were also members of other Associations. We carefully avoided having anyone on the general committee who was in any way connected with anything but the business of making and selling gas. We have not so far on the general committee any member who belongs to any industry that is connected with the gas interest—I mean by way of being a manufacturer. We want, if possible, to keep all sorts of jealousy and cause for jealousy out of the committee, so that it might be entirely harmonious in its work. You could not put on that committee a member who represented the gas meter industry, for instance, without having a feeling of jealousy among all the other manufacturers of meters. You could not appoint one in the gas stove business without making all the other gas stove manufacturers jealous, for they would think that that member would secure greater advantages for his special firm or concern than the others might be able to obtain. The object of the appointment of a committee representing the Associations, as I apprehend it, is that they may secure suitable accommodations for the exhibit which those connected with the gas industry may want to make as to location in the buildings and the amount of space; and then in a general way dividing up that space for the various exhibits that may be made. In carrying out such a programme as that it would not be possible for any one specialty to get advantage over any other as to location, or for any one manufacturer to get any advantage over his competitor in the same line of manufacturing. Thus far that programme has been faithfully carried out. I hope *this* Association will follow the course which has been adopted by the New England, American, and Western Associations in the appointment of a committee. I do not apprehend you will care to name perhaps more than one member on the committee—one or two at the outside—one would be sufficient, if you appoint the right man—which would give to the general committee a membership of nine or

ten, which is abundantly large. I would say, further, that the membership of the committee has been carefully selected from different sections of the country, so that no section should be overlooked. We have endeavored to very carefully look over the geographical surface to select men of two qualifications: First, for their fitness for the position; and second, for their location. I think they have succeeded very well in making the selections thus far. Mr. President, the action of the committee on your address, in recommending that appointment be made, the question would naturally come up, whom shall the President appoint? As I look over the personnel of the Association, and know something about the industry in Ohio, and inquire as to who would be a representative man for Ohio, by reason of the prominence which he has held in this Association, and by reason of the esteem in which he is held by the other Associations and by the fraternity throughout the country, one name in particular has been prominent in my own mind for this position as representing the Ohio Association. I have, when talking with members of the Western Association, mentioned his name, and his peculiar fitness for the position has been universally conceded. That man's name is Charles R. Faben, Jr. (Applause.) I allude to it in this way, because I know the President's extremely modest and retiring disposition, and I know that he could not be coaxed to make such an appointment unless he was compelled to do so. I am quite sure the members of the general committee who have been already appointed would gladly welcome him to their number, and would feel assured that that would be simply completing the appointment of a general committee which has thus far gone along successfully. I trust the action of this Association will be to that end. (Applause.)

Mr. Graeff—I second that motion, if it is made as a motion.

The President—I hardly think any motion was made.

Mr. Sherrard—Then I make the motion.

Mr. Cantine—I second it.

The Secretary—It is moved and seconded that Mr. Charles R. Faben, Jr., be appointed a committee of one in behalf of this Association to cooperate with similar committees appointed by the other Associations of the country to take action with regard to the matter of representing the gas industries at the World's Fair at Chicago, in 1893. [Unanimously adopted.]

The President—Gentlemen, I hardly know how to thank you for this expression. I think friend Harbison has laid it on a little too thick? However, I sincerely thank you for this honor, and I shall endeavor to represent the Ohio Association creditably.

Mr. Harbison here announced that he was obliged to leave, and, as President of the American Gas Light Association, invited the members to their meeting, next October, in New York.

Mr. George H. Christian read his paper on

THE PRESENT OUTLOOK FOR MANUFACTURED FUEL GAS.

Mr. President and Gentlemen:

The subject assigned me by the Executive Committee of our Association, is "The Present Outlook for Manufactured Fuel Gas." It will be my desire to place before you the present state of the business, in its many branches, as correctly as possible from information, and not direct knowledge.

To present the subject in a comprehensive manner it will be necessary to consider each branch separately; thus I have divided it as follows:

1st. What are we to understand by the term "fuel gas," as used in connection with our subject?

2d. Have we reached a point in the manufacture of fuel gas for domestic consumption where the efficiency of the apparatus compares favorably with that of other processess of manufacture?

3d. Is the operation of this manufacture carried on at a low cost for labor and repairs?

4th. What are the average results obtained in domestic consumption of solid fuel?

5th. What are the present results obtained in gaseous fuel combustion?

6th. What increased efficiency may we expect to obtain by using the latest improved gas appliances the market affords, and is there a field for improvement in this branch of the business?

7th. Have the people generally become familiar with the comforts attendant upon the use of gas as a fuel? And are they ready to incur the expense necessary to placing the same in their houses, knowing that there can be no saving in cost for heating, except indirectly through cleanliness and a reduction of labor and wear and tear upon household goods?

The first two points for consideration are difficult to present without bias; there are so many views held regarding the value of any heating agent, so many claims made by sanguine inventors as to the economies in manufacture by their processes, that if we do not adhere strictly to scientific demonstration we will not be able to form an intelligent view as to the present or future for fuel gas.

To determine the first point we must declare what are the requirements for a fuel gas for domestic heating; and this leads us to ask, "What is a fuel gas?" It is a gas containing elements of heat; these elements are heat units and combustion temperature, one of quantity—the other quality. The maximum product of these elements represents the greatest amount of heating value.

The formula used for obtaining combustion temperatures of gases, is

$$t = \frac{u}{w \times s} + h,$$

where t = temperature.
u = heat units.
w = weight of products of combustion
s = sp. heat " " " "
h = heat added by the air.

For the present we will omit h.

If now we multiply both sides of the equation by u we will have $ut = \frac{u^2}{ws}$. This gives us that all gases are relatively to each other as the square of their heat units divided by the product of the specific heat and weight of the products of combustion. Comparing, then, the present manufactured fuel gases with natural gas as a base, we will have:

1,000 cu. ft. of natural gas = 1,300 coal gas.
1,000 " " " = 1,200 water gas carbureted.
1,000 " " " = 2,500 water gas.
1,000 " " " = 8,500 producer gas.

These calculations are made without any estimate for excess of air. When we come to the consideration of the practical combustion of these gases we find it absolutely necessary to use air considerably in excess of that actually required for such gases as natural gas, coal gas and carbureted water gas; and this excess in practice amounts to fully 50 per cent. Fuel water gas, however, can be burned to perfect combustion with but little excess of air, 20 per cent. being ample.

Estimating 50 per cent. excess of air for natural gas, and 20 per cent. for water gas, they will stand as 1,000 : 2,100—a difference of nearly 20 per cent. in favor of water gas.

We have seen the relative value of the manufactured fuel gases with natural gas. Coal gas and carbureted water gas are good fuel gases, as they contain, volume for volume, the largest quantity of heat units, and their flame temperature is quite high.

Water gas, viz., hydrogen and carbonic oxide gases, are good fuel gases, as their combustion temperatures are very high, though the quantity of heat they contain is much less than the other two. Producer gas for many manufacturing purposes is a good fuel gas, but to be made available for domestic heating, some plan for reheating the gas before combustion must be devised, and so far as I am aware, this has not at present been practically accomplished. We are then reduced to three gases available for domestic heating: coal gas, carbureted water gas and water gas; the first two apparently leading in value, but plain water gas is a very good second.

The materials in nature that are cheap to-day, and that can be depended upon to remain so, and from which we can make our gas, are two in number; soft coal and crude oil; and we can go still further and safely say that all processes before the public using other than soft coal for a basis for fuel gas manufacture are valuable only on a small scale and not practical for large operations. This statement may seem absurd to many who are enthusiastic over crude oil gas for fuel. If they will but figure the amount of gas in one gallon of crude oil, its heating value, the extent of the production of our oil fields, the amount required for illuminating purposes to be deducted from this production, and then estimate the oil requirements for fuel gas to supply only one of the largest cities in our State, they will see their error.

From the most reliable statements that can be obtained from those interested in the manufacture of gas for fuel purposes, I find that one ton of 2,000 pounds of an average quality of soft coal will produce 45,000 cubic feet of gas, containing 16,200,000 units of heat, or 360 units per foot. Assuming the carbon in the coal to weigh 1,750 pounds, and estimating 14,500 units per pound, we have a total of 25,375,000 units. This shows the process to have an efficiency of 64 per cent.

In carbureted water gas, allowing of the same per cent. of ash as in the former case, efficiencies as high as 70 per cent. can be obtained. In coal gas manufacture proper, it is quite difficult to determine efficiencies, as the residuals that remain are largely only valuable as they themselves can be converted into gas through the medium of a water gas process. By combining coal gas and water gas, 38,000 cubic feet of a

gas containing 400 units per foot can be had, showing an efficiency of 60 per cent.

We find, then, carbureted water gas leading in efficiency of manufacture, water gas second, and coal and water gas third.

The amount of labor and repair cost varies considerably in different localities. I have endeavored to obtain an average cost for the various gases as obtains in daily practice.

Labor and repairs cost, Goal Gas	13c.
" " " " Coal and Water Gas	7½c.
" " " " Carbureted Water Gas	6c.
" " " " Water Gas	5c.

These figures are based on continuous running. Estimating this cost on basis of heat units in each gas, as they stand:

Labor and repairs cost, Coal Gas	13c.
" " " " Coal and Water Gas	10c.
" " " " Carbureted Water Gas	6c.
" " " " Water Gas	9½c.
" " " " Coal and Carbureted Water Gas	8c.

Here carbureted water gas gives lowest labor cost.

When we come to consider distribution cost, it needs but little argument to convince you that coal gas ranks first. The cost for street mains, and holders for storage, form two of the largest items in total cost for fuel gas plant; meters and service connections swell that cost materially. To maintain low capital cost must be the aim of all fuel gas engineers. This cannot be accomplished if we must use the maximum sizes of mains, services, meters and holders to handle the very much larger volumes of gas required to do the work when using a gas of low heating value.

The experiences of the natural gas companies show what difficulties are met with in distributing gas, owing to the sudden and varying demands. How much greater these difficulties when storage is necessary to meet these demands!

We now come to consider results obtained in practice in the combustion of fuels, and will first take solid fuel as used under boilers. I will take an example of two boilers running steadily for six months with nut coal. They gave an evaporation of 8 1-10 pounds of water from and at 212 degrees, or nearly 55 per cent. efficiency. Natural gas was afterwards burned under these boilers for four months, and it required 18,000 cubic feet of gas to equal one ton of coal, or an efficiency of 80 per cent. for the gas. This efficiency was no doubt increased by using heated air to mix with the gas.

Coal as used in domestic heating gives far different results. Of one ton of hard coal burned in a base burner stove, 25 per cent. will be returned as ash, a large per cent. of the remainder of the fuel will be burned to carbonic oxide or imperfect combustion. If the whole product were imperfect combustion we would have a two thirds loss, or but 27 per cent. of the total heat of the fuel generated. Allowing of one-fourth of the fuel remaining burned to perfect combustion, which would be a fair average for the twenty-four hours of heating, and we will have but 33 per cent. generated. Now in our best arranged stoves we utilize about 70 per cent. of the heat generated, or a total for solid fuel of combustion for domestic purposes of 23 per cent. This seems indeed a very poor showing for solid fuel, and yet I think if I err it will be on the side of estimating it too high. We find in practice that it requires 20,000 cubic feet of natural gas to equal one ton of hard coal for domestic heating. Thus 20,000,000 heat units are consumed to obtain 6,700,000 units in useful effect, showing only 53 per cent. total efficiency in natural gas combustion. Where is this loss? Surely the heat utilized of that generated is fully as great as obtains in solid fuel combustion, so the loss here is in the failure to generate, with any degree of efficiency, the heat in the gas. There can be no doubt as to the difficulty, in practice, of obtaining perfect combustion from those gases containing large volumes of hydrocarbon gases. A previous admixture of air is required to prevent smoke, and it is also supposed to be necessary to admit air in excess to insure perfect combustion. My experience is not in accord with this view, as I will show you.

I had occasion to change a water gas works over to carbureted air gas. A merchant in the town was manufacturing tin cans on a large scale, and had been using water gas solder heaters. These had to be changed to burners for burning the carbureted gas. We used Goodwin's automatic air bulbs and perforated pipe burner. We soon found the heat insufficient to do the work. The air mixers would give ample air to produce a blue flame, so we decided that the burner was too high or too low, *i. e.*, too near to or far away from the plate to be heated, and on which the solder rested. We raised and lowered the burner to a dozen different positions, with no better results. I will here describe these heaters: They were flat on top, with three sides of cast iron, and about four inches deep; the fourth side was open and used as a chimney. The three sides were solid, without any opening in them. When we found the changing of the burner produced no effect, and knowing there was heat sufficient in the gas, as every 1,000 cubic feet contained the gas from seven gallons of Lima crude oil, we determined the trouble to be with the burning of the gas. We finally decided to drill small holes through the three side plates of the furnace just below the top plate for admitting air to the burning gases. This air mingled with the products of the first combustion, and combined with the carbonic oxide and burned it to acid. The effect was marvellous. With but one-half of the quantity of gas previously used heat sufficient could be generated.

This method of burning gas is different from that which obtains in general practice in heating stoves; and I am thoroughly convinced that we lose large quantities of heat in this way. We find the best authorities on solid fuel combustion advocating this principle, namely, admitting air through small orifices above the fuel bed. Professor Daniell says: "There can be no doubt that the affinity of hydrogen for oxygen is stronger than that of carbon, and that for the complete combustion of the different forms of hydro carbon it is well known that the whole of the carbon is never combined with oxygen in the process of combustion unless a large excess of oxygen be present; furthermore, in burning coke, or when coal has been burned down to a clear, red fire on the grate bars, although the combustion on the grate may appear perfect, and no flame or smoke be produced, there is a large amount of useful heat lost owing to the formation of carbonic oxide, which, not finding a fresh supply of air at a proper place, necessarily passes off unconsumed." In further experiment he determined that the best and only place to introduce air to a furnace is at the furnace door or behind the bridge wall, and not under and through the fuel bed; and that the combustion produced in this way gave an increase in temperature in the flues of the boiler of over 400 degrees, showing conclusively the combustion of the oxide to acid. This air, however, should be admitted in innumerable little jets by passing the same through thin or small orifices in the furnnace door; any opening of the door itself and allowing of the air to pass in in mass will have the contrary effect, and rob the fire of effective heat.

The waste that is had in natural gas combustion for domestic use is altogether great, and such general waste in manufactured gas would ruin the business. There are those engaged in the manufacture of heating and cooking stoves who assure us of 85 per cent. utilization of the heat generated; generating, then, but 60 per cent., we would have one-half of the heat in useful effect, or 14,000 cubic feet of natural gas equaling one ton of coal.

Water gas for practical use has a great advantage over other gas fuels, in that perfect combustion must take place and its full equivalent of heat be generated. We thus obtain in its use total efficiencies equaling 70 per cent We have no reason for doubting statements made for this gas, that 20,000 cubic feet will equal one ton of hard coal for domestic heating.

We now come to consider the relation of the consumer toward the manufacturer. The consumer holds the position of demand, the manufacturer that of supply, and as in most commercial affairs the demand regulates the price, so will it in this business. Prices for illuminating gas in the past have ruled higher in this country than they would had competition been sharper. This is evidenced from the fact of most gas companies having established two prices for the same product—the rate for cooking very materially less than that for illumination. This lower rate was made to meet the ruling prices of other fuels. This branch of the business has become very extensive, and is increasing quite as rapidly as the main business. The average ruling price for gas for heating and cooking has been $1.00 per 1,000 cubic feet, and at this price, gas has proven to be as fully an economical summer fuel as any other possessing the same degree of convenience and comfort for the housekeeper, but for any general heating this rate will be found to be entirely too expensive.

The advent and very general use of natural gas wherever obtainable, has proven its very great convenience and comfort, and to-day we find the public clamorous for gaseous fuel. The people are ready for the change and willing to meet the necessary expense connected with adopting the same, provided they can be assured that the cost for heating will not be, to any marked degree, greater than by solid fuel. In the early days of natural gas distribution, to introduce the new fuel very generally and rapidly, the companies contracted to do heating and cooking for a certain lump sum per month per stove. They soon found this method very conducive to great waste of the fuel and they aban-

doned it, and went back to the metering of the gas. The present illuminating gas companies cannot afford to do heating for a lump sum per month, even for a short time to thereby more generally introduce gas as a fuel; they must, however, recognize this growing demand for a gas fuel, and reduce the price of their illuminating gas for heating purposes until they reach a figure that will give general satisfaction to their patrons, and guarantee to the company a rapid and large increase in business. It is better thus to establish a sales value for your product than by either keeping the price too high, or reducing it too low, suffer loss.

Theory and practice were born to disagree. We can calculate the efficiencies of gas and solid fuel heating, and the efficiencies of gas manufacture, and from these deduce the sales value of our product; but practice determines differently. The many economical devices too frequently prove, in general practice, useless; and it is not alone the quantity needed to do the work, but also that which can be wasted that governs the cost of an article; and this trebly so in this field, where waste is so easily had. To the prevention of this waste much energy must be devoted and the people more generally taught the methods of burning gas economically.

The use of natural gas has given a great impetus to the demands by the people for fuel gas, yet the experience had in the burning of natural gas by the very wasteful methods now employed, will hinder rather than advance their chances for obtaining the manufactured article.

Finally, we must view our subject from the standpoint of profit and loss, and see what must be done to make this business a commercial success. On account of the large amount of capital invested in the illuminating gas business, it devolves upon these companies to utilize their present plants to convey gas for fuel as well as light, and they must take the initiative in this movement. Let the manufacturers of coal gas and carbureted water gas combined calculate the cost of their gas in the holder per 1,000 feet for material, labor and repairs, in any section where gas coal can be had for $3 per ton, and Lima naphtha for 3 cents per gallon. The gas made will be 19-candle value, and contain 750,000 units of heat. I believe I do not err when I say that the present cost for distribution, interest, taxes, etc., does not exceed the cost of gas in the holder in any works the bonded debt of which is not excessive; and it should be remembered that by doubling the amount of gas sold you should reduce distribution cost more than one-third. Each company could thus determine for itself whether it could not well afford to enter the fuel gas field by establishing a very low rate for gas used for fuel purposes; and I think that that rate would be found to be very much lower than has heretofore been generally considered advisable or possible.

Natural gas companies are selling gas for 15 cents per 1,000 feet. Interest, taxes, distribution, improvements and repairs must amount to 6 or 7 cents per 1,000 feet, leaving them a profit of from 8 to 9 cents. This sum has been ample to pay large dividends and set aside a surplus. Allowing ten cents per 1,000 profit to illuminating gas companies on their sales of gas for fuel purposes, and at what rate can they afford to sell such gas?

Suppose for the sake of an example, that some company should be so favorably situated as to feel warranted in making this rate 50 cents per 1,000. Can the consumer afford to pay this price for gas for heating and cooking? Natural gas as now wastefully burned is, at 15 cents per 1,000, equal in price to hard coal at $3 per net ton. When we can burn coal gas with a total efficiency of 65 per cent., 15,000 cubic feet of it will do as much heating as 20,000 cubic feet of natural gas now does. Coal gas, then, at 50 cents per 1,000 would equal hard coal at $7.50 per net ton. This is so little in excess of the cost of hard coal fuel, when we consider the cost of removing the ashes and dirt, that I believe its general use as a fuel at that price could be assured.

That a combined fuel and illuminating gas plant can be made a successful business venture cannot be doubted. The plant at Jackson, Mich., was started some three years ago, at a time when all previous attempts in this direction had proven failures. To-day this plant is in successful operation, and doing a larger business than in any previous year. The fact of those financially interested in the Jackson plant having advanced money to build and operate a similar plant on a far larger scale, should be proof sufficient even to the most skeptical that fuel gas can be made a success.

Discussion.

Mr. Graeff—I have a suggestion which probably Mr. Butterworth can answer as well as anyone. Mr. Christian says that "the extravagant use of natural gas will be very apt to hinder the chances of consumers obtaining the manufactured gas." Mr. Butterworth comes from a city where a natural gas company has recently been very unfortunate, and he knows the condition in which the natural gas consumers of that city have been. As I understand it, they are willing to take the natural gas back again, and pay more for it than they originally agreed to do. There are prospects there that a prophet at last shall not be without honor in his own country, and Columbus may have an opportunity to use fuel gas at a not very remote day. I believe the use of natural gas, no matter how wasteful it has been, has done more to hasten the coming of what we call fuel gas as a commercial article than anything else possibly could have done.

The Secretary.—In my opinion Mr. Graeff is correct, and that natural gas, when once it has been introduced and used in a town, is a great educator in the line of artificial fuel gas when natural gas shall have become a thing of the past. At the same time I think Mr. Christian is right in his statement that the more wastefully natural gas has been burned the more it will prejudice the introduction of artificial fuel gas. If natural gas could be burned in economical appliances it would be easier to introduce artificial fuel gas, as people having been educated to use it economically would use artificial gas economically, which would be favorable to its more general introduction. We have tried the experiment of furnishing gas at 50 cents per 1,000 feet to a limited number of houses for heating purposes, and it possibly might be interesting to state the results of that experiment. As soon as the natural gas failed, we at once made known our willingness to furnish gas at 50 cents per 1,000 for heating a limited number of houses. The offer was accepted by several who were anxious to do almost anything to retain the convenience and the comfort of natural gas. I will here read a report on the results of this experiment, which was rendered by our Inspector, Mr. Anson, who had charge of the practical part of the work:

"COLUMBUS, O., March 14, 1891.

"The following report of the results of our experiments wifh 50 cent fuel gas is hereby submitted: Mr. Harrington's house, an eight-room brick dwelling, was connected from the main to the curb with a 2-inch service pipe, which was connected at that point to a 1½ inch natural gas service; a 30-light meter was set and connected to natural gas distributing pipe; this pipe was connected to one 6-flue, hot air furnace, one coal range and one small heating stove. After an unsatisfactory trial of the coal range, it was disconnected and the heating stove and furnace were further experimented with. The coal range consumed 50 cu. ft. of gas per hour and did not bake well. The heating stove was made to consume 30 cu. ft. per hour, and was very satisfactory.

"The furnace, having a 16-foot sectional burner with 1¼-inch connecting pipes, was supplied with two 1-inch pipes, they being connected to the 1½-inch main supply. The same mixers that were in use with the natural gas were used, and after reaming to obtain the proper mixture they were found to consume 210 cubic feet per hour, under a pressure of 2 inches. At this rate of consumption a temperature varying from 70° to 64° was maintained in the house, while the temperature out of doors was ranging from 40° to 34°. Other mixers were then secured, consisting of a 3-inch by 1¼-inch reducer (the 1¼-inch end of reducer screwed on to the 1¼-inch connecting pipe on burner), and the 3-inch end of the reducer was used as an air chamber; into the 3-inch end of the reducer or mixer, was inserted a 1½-inch nipple, which had one end reduced to about a ¼ inch opening, and the other end having a long or running thread, so as to adjust it. This was screwed into the ½-inch end of an 1-inch by ½-inch reducer, which screwed on to the 1-inch gas-supply pipe, thereby forming the mixer. These mixers, when turned on full head, consumed 120 cubic feet per hour, and maintained the same temperature in the house as did the previously used mixers, with conditions alike. These mixers were then reduced at the gas supply jet in mixer, and the consumption was cut down to 95 cubic feet per hour under the same pressure; the temperature indoors, then, could not be raised above 62°, with temperature out of doors about 36°; but with three of the registers closed, and three registers left open (the three rooms communicating), the temperature in the rooms was kept at 70°. The cold-air duct to the furnace was kept closed, as the air was too cold to heat, efficiently, under the present condition. Fire brick were used in this furnace. After the latter experiment with the "coal" furnace, a portable Westinghouse, hot-air furnace was brought to the same house and set up in another room in the same cellar. This furnace, being rather small for so large a house, originally had but three outlets for flue pipes, and as six were necessary, three more were added; the burner in this furnace, like the other, is a sectional one, and in shape similar to a hand-hole plate of a boiler, having a flat surface with numerous perforations about $\frac{3}{16}$-inch in diameter. The mixer on each section of the burner is similar to the one described as used in the coal furnace, being an open, bell-shaped casting of about 2½ inches in diameter, into which the gas jet of about

½-inch in diameter is inserted. The burner, after the mixers were properly adjusted, to prevent "lighting back," and to obtain proper mixture, consumed 200 cubic feet per hour, at 2 inches pressure, and at no time through the six registers could the temperature in the house be raised above 66°. Three rooms or registers were then tried alone, as with the other furnace, and a temperature of 72° was obtained while the temperature out of doors was 36°. When the consumption was reduced by closing the gas jet, the burner would "light back." Nothing further was tried with this furnace, as it was thought to be too small. The foregoing observations were made, in each instance, after the furnaces had been burning ten hours. This furnace contained no firebrick, the open burner only being used. The gas was turned on in this house on Jan. 17th, and turned off Feb. 24th, when the meter showed 25,800 cubic feet of gas had been consumed in the 39 days, or 936 hours; the average consumption per hour being 27 feet ($12.90 was received for fuel gas). This house is not using gas at present.

"Another house (Mr. Johnson's,) was connected in the same manner; that is, a 2-inch service was connected to natural gas service at the curb, and a 30 light meter set. In this house is a hot air furnace and two Westinghouse grates; gas was used in the furnace but a short time (merely as an experiment by Mr. Johnson), and as not very satisfactory results were obtained it was disconnected. The grates are still in use, in conjunction with the hot air furnace, which is now burning coal, and they are pronounced quite satisfactory. The grates consume about 35 cubic feet per hour, at 2⅛ inches pressure, and from the date on which the meter was set (Jan. 17th, to and including Feb. 24th,) 24,200 cubic feet of gas was consumed, $12.10 having been paid for the same. Gas is still in use in this house.

"Another house (Medberry's) having a steam heating apparatus, gas log, and four slag fires in grates, was connected in the same manner as the preceding houses, on January 19th, and the burner in the boiler was lighted on that date, and has been burning continually since then, day and night. From 1½ to 2 pounds of steam pressure is maintained, which is all that is required, as the valve on the gas supply pipe is attached to the diaphragm of the boiler, which automatically regulates the flow of gas to the burner. This burner consumes 120 cubic feet per hour, at 1.8 inch pressure. The gas log consumes about 35 cubic feet per hour, and is as satisfactory as was the natural gas. The slag fires on second floor consume about 50 cubic feet per hour each, and are quite satisfactory. The two slag fires on first floor consume from 40 to 50 cubic feet per hour, at 1.8 inch pressure, and are not as satisfactory as the upper grates, owing to their location and small size of pipe supplying them; 70° temperature is maintained in this house. From January 19th to February 23d (36 days, or 864 hours), 148,600 cubic feet of gas was consumed, making an average of 172 cubic feet per hour. This gas is consumed mostly in the boiler. Gas is still in use in this house. ($74.30 was paid for gas consumed during the 36 days.)

"Another house (Dr. Loving's) was connected with a service, independent of the natural gas service, from the main to the meter, and from there connected to the natural gas distributing pipe. Four slag fires (in grates only) were connected, and three of these that were connected with a large supply pipe were pronounced satisfactory as to their efficiency, but were considered to be too expensive to be maintained steadily, while the fourth fire which was farthest from main supply and supplied by a ½-inch pipe (laid in such a manner as to require expense and inconvenience to change), therefore could not be fairly tried, was used only in mild weather and was afterwards abandoned. Gas was turned on in this house on January 21st and off February 24th; 51,600 cubic feet of gas was consumed. ($25.80 was paid for same.) The pressure obtained in this house was 1.8 inch.

"Another house (Prof. Orton's) was connected by placing a 10-light meter independent of the house meter, and attaching it to the service already in (¾ inch). Two Westinghouse grates and one Westinghouse reflector were connected. While these were all very efficient, yet they were used only occasionally, especially so as to the grates, and not to heat the rooms generally as a hot air furnace; burning coal was in use. The grates consume about 35 cubic feet per hour, and the reflector about 38 cubic feet at 2 inches pressure. The reflector was used in a room 10 × 16 × 12 feet, and was lighted in the after part of the day, when it became necessary to use the room—it was a study or laboratory—and was turned on full head from 15 to 20 minutes. When the room became warm enough, the flow of gas was reduced a little less than one half, and the room was kept thoroughly heated. This reflector is a very efficient heater, but it gave off an unpleasant odor, notwithstanding it had a flue connection. (This reflector has since been taken out, and another grate fire put in.) From January 27th to February 23d, 8,300 cubic feet of gas had been consumed, at a cost of $4.15. W. H. Anson, Inspector."

The President—That report is very interesting as the result of practical experience and operation. Are there any further remarks on the subject?

Mr. Christian—I think the odor from the burning of the gas in the Westinghouse reflector would be an indication that there was imperfect combustion. In our town, if in the burning of natural gas any odor is perceptible it is because there is not sufficient air to burn it. The way to correct that is to draw in more air.

Mr. McCook—I do not understand how, with the Westinghouse furnace, you can get the heat unless the furnace itself is cased in. How did you keep the heat in?

The Secretary—We did not keep the heat in; we warmed the cellar. We found however successful that plan might be with natural gas it would not do with artificial gas. The Westinghouse people did not make any provision for bricking the furnace in. It was an ordinary portable furnace. We came to the conclusion that if the family could live down cellar, or if they could take the furnace up into their living room, it would be first rate. It was virtually a big stove.

Mr. Christian—The results obtained in the burning of natural gas under a boiler show that very great efficiency may be obtained in that way by heating water. In order to get the best results and to get the heat where you want it, the best method would be by the use of either hot water or steam; or to arrange the stove so that it would radiate heat (if it is in the cellar) on to pipes containing water, and let the water carry the heat off. In hot water heating we get a very good percentage of the heat. After it has been generated and gone into the water, we get about 65 per cent. of that heat. Every cubic foot of water carries 10,000 units of heat; and we can utilize 6,500 units of that at the present time. With steam we get still better results. I think we get over 80 per cent. of steam. As a general rule where hard coal fuel is used the steam runs down at night, and considerable time in the morning is taken up before you get the steam up, consequently there is a loss in that way. On that account hot water circulation seems to be preferable to steam.

The Secretary—I was under that impression myself until I had a talk with Mr. McMillin on the subject. I expressed my opinion to the effect that the hot water circulation seemed to afford the best means of heating with gas fuel, and he said when he came to build his own house he examined the subject very carefully (his idea was similar), but found it would require such a large surface that he would have to fill his rooms up with radiators; further, it would be difficult to force the heat, if a sudden cold spell should come. He would have to put a great quantity of hot water through the radiators very rapidly in order to heat a room, hence with gas fuel he thought hot water heating would be very expensive. I cannot say that I consider the results as very discouraging in bearing on the future of fuel gas. They seem to indicate more than anything else that there is a necessity for economical appliances for the burning of gas. If economical appliances were to be had, such as a good gas furnace bricked in so that the heat would not radiate into the cellar, or even reflectors, if we could get rid of the odor (as I think we could), then, I think, these results would not be at all discouraging.

Mr. McCook—Was that reflector in a large room?

The Secretary—Yes; 12 by 15 feet. Mr. Ketchum, of the Westinghouse Company, says this is the first time they have heard the objection of odor urged, so I am satisfied some local conditions made that experiment result unfavorably. We had a large demand for fuel gas at 50 cents per thousand, but the applicants were afraid to cut loose entirely from their coal furnaces. They wanted to use their furnaces for heating the houses, and to use 50 cent gas for auxiliary and for ornamental purposes. We could sell a great deal of gas at 50 cents, I assure you.

Mr. Nash—Is it your intention to go on furnishing gas at 50 cents for grates, and such purposes?

The Secretary—Not at present. Personally I have concluded that the best way of heating a house economically with gas, with our present appliances, was to have a stove in each room. That would be open to the objection that a man would not want to buy a dozen stoves for his house, to say nothing of their unsightliness in each room; but in my judgment that is the way to heat a house with gas at present.

On motion of Mr. Penn the thanks of the Association were voted to Mr. Christian.

Second Day—Afternoon Session.

ELECTION OF OFFICERS.

The President—The first thing in order is the selection of officers for the ensuing year.

Mr. Cantine withdrew in favor of Mr. Wilkiemeyer, who was, on motion of Mr. McCook, elected President by acclamation.

Mr. Wilkiemeyer—In his address to us the President said the world would place a man a little below the level at which he placed himself. My ambition has never been so high as to cause me to aspire to the position of President of the Ohio Gas Light Association, so that this election should not be taken as indicating where I would place myself. I will try hard to fill the position creditably. I cannot say whether my efforts will be successful or not. I thank you heartily for the honor you have done me. I wish we could lighten the labor of our Secretary somewhat, by accepting at once any demand which he makes upon us for papers. Each one of us ought to do his share, and whenever we have a request from him we ought to respond promptly. You can select a general to lead an army, but if that army will not fight he cannot gain a battle. I again thank you for this honor which you have bestowed upon me.

A ballot was then cast for the other candidates nominated by the committee, and the following were declared duly elected :

Vice-President—C. H. Welch.
Secretary—Irvin Butterworth.
Treasurer—George H. Tayler.

THE QUESTION-BOX.

The President—We will proceed to a consideration of the remaining questions. Number 4 is—

"*Given a town of* 10,000 *population, output of gas* 8,000,000, 250 *meters,* 5 *miles of street mains, selling coal gas at* $2 *per* 1,000 (*net*), *cost of coal* $3 25, *with the street lighting done by a municipal plant: Can an incandescent electric system be operated successfully in opposition, using steam power?*"

Mr. Wilkiemeyer—We have had at times a representative of an electric light company in this room, and he has quite frequently asked me the name of that town. He seems very anxious to tackle that place. If that town exists, there certainly is a great deal of room to furnish a little more gas in it. As I understand it, he has five miles of mains, and distributes about 8,000,000 feet of gas, through 250 meters. If an electric light company were to come in there, they would certainly show that man where he could furnish them light.

The President -Considering that question answered in the affirmative, I will read the next :

"*To what extent, and under what conditions, is a gas company liable for damages to consumers, either by leakage, or explosion caused by leakage, in the streets or in private residences?*"

Mr. McIlhenny—I know of a case in which a store in a town, that had been empty for some time,was rented for an evening to give an entertainment in—a supper of some kind—for charitable purposes. The people who rented it paid no attention to the gas fixtures. It seems that there was a leak under the ceiling. Everything looked as it should, but when the supper was spread, an explosion occurred which threw the plaster down on the table, and, of course, spoiled the entertainment. The gas company was sued for the loss and damages were given against them.

The Secretary—Did the Gas Company do the pipe fitting in the house originally ?

Mr. McIlhenny—No ; gasfitters in the town had done the fitting.

The Secretary—Was the work approved by the Gas Company ?

Mr. McIlhenny—I suppose so.

The Secretary—Approved simply to the extent that the fitting was tight upon the completion of the work ?

Mr. McIlhenny—Yes.

The Secretary—In my judgment that was a very unfair decision.

Mr. McIlhenny—The jury gave a verdict in favor of the party who lost the supper.

The Secretary—They should have sued the gasfitter ; then, perhaps, the verdict of the jury would have been correct.

Mr. Cantine—Mr. McIlhenny did not state whether the Gas Company had charged anything for the gas—we have never charged anything for entertainments given by the churches—and, therefore, it would hardly be right to sue us for damages in case of an explosion of that kind.

Mr. McIlhenny—In this case the Gas Company knew nothing about the matter. The accident happened in that way, suit was brought, and the jury gave a verdict against the Company.

Mr. Nash—I do not understand Mr. McIlhenny to say that the Gas Company had been notified of any leak.

Mr. McIlhenny—No.

Mr. Sherrard—Lawyers here will remember the noted case reported from Cleveland, where the Gas Company was sued—the case is reported in 32 Ohio State Reports. The city granted the Gas Company the right to lay its mains through its streets, and specified the way the pipes should be laid, and the Gas Company laid the pipes in accordance with those instructions. A committee from the Council inspected the work. After the gas had been run through the mains an explosion occurred that defaced a stone house, tore out the windows, knocked down the plastering, damaging it considerably, probably to the extent of $500 or $600. The owner sued the Gas Company for damages. The Company defended the suit on the ground that it laid its mains in accordance with the instructions of the city authorities, who had appointed an inspecting committee which inspected and accepted the work as done. The case was tried in Cleveland, and the Judge instructed the jury that the Company was liable. An appeal was taken to the District Court (it was then the District Court, not the Circuit Court as now), which Court reversed the decision, holding that the Gas Company had complied with all the conditions precedent. An appeal was taken to the Supreme Court, and that authority sustained the decision of the District Court, holding that the Gas Company was not responsible. Where a gas company has performed its mainlaying work well (that fact must be shown, and the burden of proof would rest upon the gas company to show that fact if sued), should a leak happen to occur, as we all know it will, unless that defect were brought to the knowledge of the gas company the court would hold that the gas company was not responsible. I think they are not responsible.

The Secretary—I was reading the other day an account of Mr. Slater's experience in Providence. The Gas Company there was called on to pay damages under these circumstances : The city constructed a sewer which came close to one of the Gas Company's mains ; soon afterwards the earth settled and broke the main in two, and the escaping gas leaked into a greenhouse close by and destroyed the flowers. The Gas Company had to pay damages to the extent of $3,000—probably that includes some legal expenses, but it cost the Company that sum. It seems to me that that was very unjust.

Mr. McIlhenny—The lesson to be drawn from a question like this, which is a very important one, is, in the first place, it is better not to let any gas leak. In the next place, juries are pretty apt to give verdicts against a gas company. Of course an appeal to a higher court may reverse such a verdict, but the better plan is to avoid such troubles. I know of quite a number of other cases, not worth mentioning now, but I think that the better plan would be to avoid any such liability. In Saratoga at one time, a great many trees were destroyed by leaks from a main, and I think that the Gas Company was held responsible for the loss of the trees. Such claims for damages remind us that we ought to look out for our leaks, and not have them happen, but keep the gas in the pipe, and sell it, which is much better than letting it leak out in the streets.

Mr. President—The next question is—

"*Suppose the normal pressure at the inlet of gasholder is four inches, the pressure at inlet of center-seal* 7 *inches, the pressure at inlet of standard scrubber* 9 *inches, and the pressure at outlet of exhauster* 11 *inches, and that naphthaline accumulates in the inlet to holder so as to raise the pressure there to* 5 *inches; will this obstruction increase the pressure an even inch at the other points mentioned?*"

Mr. Printz—At first one would think that an easy question to answer—that it certainly would raise the pressure equally at all points from the first increase to the point of pressure. I would look at it in that way. Yet there may be some other reason for its not being the case. My own judgment would be that if the pressure were increased an inch at the inlet of holder that increase of one inch would follow right along at all the other points. I do not see any reason why it should be otherwise.

The Secretary—This question is an interesting one to me. I did not propose it, but having had it submitted, I experimented at our works and found that the pressure did not increase an inch at the other points mentioned. That seemed to me to be a very remarkable fact, and I am unable yet to explain it. It seems remarkable that, the gas being driven through a system of pipes and apparatus by a motive power (the exhauster), and at a distance from the exhauster you interpose an obstruction which causes the pressure at that point to rise one inch, the exhauster does not show at its outlet one more inch of pressure. But I tested the matter thoroughly several times and in different ways, and found that the pressure was increased less than an inch at the exhauster. While it increased one inch at the point where the naphthaline had accumulated, or where, as in this instance, we closed a valve so as to raise the pressure one inch more at that point, the pressure at the exhauster only increased .7 of an inch. In filling our holder with

gas we would note the pressure at the holder inlet and at the exhauster. When the holder cupped, and the second section was caught and added that much more pressure at the holder inlet, the same pressure was not added at the exhauster; it was less. I do not know as yet how to account for that. It is an axiom among physicists that friction is due to the velocity only, and that pressures do not affect friction if you pass the same volume. But this seems to indicate that some other factor must enter in.

Mr. McIlhenny—If that had been water instead of gas, I think the increase in pressure would have have been equal all round—from the exhauster to the point of obstruction; but gas being an elastic fluid, and moving by a different law from water pressure, we have a different result. I think the elasticity of the gas explains it.

The Secretary—I do not think that explains it.

Mr. McIlhenny—If that had been water in the pipe instead of gas, it would have had the same increase in pressure all along, would it not?

The Secretary—One would think so, as one would naturally think would be the case with gas, in this instance.

Mr. McIlhenny—But the law governing the movement of elastic fluids differs somewhat. Many years ago I heard a lecture delivered by an eminent professor, who said he could make gas at the coal mine and force it to the large cities. He afterward became the manager of a gas works, and built a gas works three or four miles from the city; but he found he could not force the gas into the city with the same pressure. He had to put in one exhauster to draw it and one to push it. The gas did not hold its pressure, and he could not keep it up all along the line.

The Secretary—That would have been the case also had he been pumping or forcing water. Although this phenomenon may be due to the fact that gas is an elastic fluid, while water is more or less non elastic, and the explanation may somehow lie in that fact; yet I do not see how it is that if you increase the pressure necessary to be overcome you are not obliged to increase the power just that much. I do not see what hidden force or power there is between the exhauster and the point where the obstruction occurs that takes care of this additional pressure.

The President—We will take the next question—

"*Has illuminating gas been improved and cheapened during the past three years as much as has the incandescent electric light?*"

Mr. Cantine—I do not think that gas has made a greater progress than the other. I do not think we produce any more candle power than we did three years ago, and I do not think the electric lamps are any better, more brilliant, or more diffusive. The only thing I see about it in favor of the latter is the fact that the lamps are less in price than they were.

Mr. McIlhenny—Do they last as long?

Mr. Cantine—I am doubtful about that. I think they have been cheapened at the expense of the light. I know we are buying at our station a good many more lamps than we like to pay for, but we have to do it, nevertheless. You well know that the price of gas in nearly all towns, for the past three years, has been below the price of five, six, or ten years ago—below what you would have then thought possible. Dollar and $1.25 gas is quite a common thing in towns of rather small size. I think that a few years ago gas companies would have had no hesitation about going into court and swearing it would not be possible for them to produce gas for what they are now getting for it and make any profit. I am not particularly prejudiced against the incandescent light. I think it is a sort of raiding element, brought in by the manufacturers to compel someone to buy it. I think the man who does buy it, except in a case of extreme necessity, must always regret it, particularly if he operates it in connection with gas works, for then he simply comes in competition with himself, and with no corresponding good. His investment is rather necessarily a poor one, and he will be very fortunate, if he wants to sell out, if he can get 50 cents on the dollar. There are limits beyond which you cannot go in electric lighting. The number of lights does not make so much difference as a greater or increased output of gas, for the more gas you sell the cheaper you can sell it; but extensions in the line of conveying the current for incandescent lights and for power and all that sort of thing do not diminish the expenses as much as obtain with an increased output of gas.

The President—I do not know that I ever heard a comparison of just how much the cost of making incandescent light has been reduced as compared with gas. I do not know that it has ever been reduced any. I could only say just what probably we all know, that the incandescent light is a more expensive light to make or use, if properly paid for, than gas giving the same amount of light. We all know that. But to what extent the cost of producing the incandescent light has been reduced in the past three years, I have not the slightest conception. I know in our case the cost of producing gas is not any more than it was three years ago, notwithstanding we are not doing as large a volume of business as we did formerly. Several factors have contributed to reduce the volume of our business. Formerly the streets were lighted with gas lamps, but for the last two or three years they have been lighted more exclusively with arc lights. That has made one inroad on our business. Then the incandescent lighting has been pushed very thoroughly, and in some cases concerns have put in their own plants. We also gave up the manufacture of coal gas to adopt the manufacture and distribution of a water gas of higher illuminating power and greater gravity than coal gas. Natural gas has also made inroads on our fuel business. Our business would have suffered greater loss if we had not extended our systems of mains and reached new territory. I think that is one thing often lost sight of in city councils, and by others who are authorized to name prices. They do not realize that in that part of the city where gas lighting would be profitable, if the gas company enjoyed the entire field, they have the liveliest kind of competition, from arc and incandescent lights and all others; whereas in the outlying districts, where it is unprofitable, the gas company is allowed to enjoy that field alone.

Mr. Barker—If it be in the line of this inquiry, there may be no harm in saying I believe it is not claimed by the electric light people that they can get any more incandescent lamps per horse power now than they did three years ago. Of course, within certain limits, the business of incandescent electric lighting is of such a character that the light can be sold for a little less when the output increases. A similar principle governs you in case of an increased output of gas. I do not think, however, that there is any more candle power in the incandescent light per horse power now than there was three years ago. I am aware of the fact that certain manufacturers of electrical appliances, certain proprietors of so-called systems, think they have discovered a scheme by which more lights can be obtained per horse power than are now in use, but that is a matter as yet only in the laboratory; and they may find themselves disappointed when they come to put it into commercial use.

The President—We will proceed to another question—

"*What is the best method of burning carbon from retorts?*"

Mr. Sherrard—Burn it out with steam.

The Secretary—At Columbus we simply use the system of building a flue of firebrick in the retort, tight enough to convey a current of air back, then remove the plug at top of stand-pipe, and let the current of air go through without any steam at all. In 12 or 18 hours we have the carbon removed. It is a very satisfactory method. I would not think that anything better would be wanted, although there may be a better method.

Mr. Nash—I have tried the method mentioned by Mr. Butterworth, and also have tried steam. Although I think the steam method is quicker, I prefer to do it the other way—simply by drawing it out by a natural draft through the stand-pipe. I think it is less injurious to the stand-pipe.

Mr. Penn—Is not steam more injurious to the retorts than air?

Mr. Nash—Yes.

Mr. Printz—As I understand it, the steam is not used so much for the purpose of burning, it is simply used to create a current or draft of air, so as to take through a larger body of air. I know an appliance that is used, which we might call a compound blower, the steam merely acting as a syphon for drawing in the air. Only a small quantity of steam is used. The trouble I found by the use of steam was that the retort would get up to too high a heat, and, unless we were very careful, we would burn the mouthpiece bolts. I prefer the method spoken of by Mr. Butterworth and Mr. Nash, for that reason. Although you would be longer at it, yet you are not liable to burn the bolts off the mouthpiece. Nowadays, as a rule, we do not take off the cap to the stand-pipe, but just simply slack the lid a little. We generally build a course of brick just inside the mouthpiece, so as to protect the mouthpiece at the joints.

We have had very good success in burning in that way.

The President—The next question is—

"*What is the best method of repairing leaky gasholder tanks?*"

Mr. Nash—A short time ago I noticed, in the American Gas Light Journal, an account of an experience with a leaky tank given at the meeting of the New England Association. The speaker seemed to think that banding the tank with iron was a very good plan.

The President—Perhaps the best way to answer this question is by referring to the paper of Mr. Sherman, and the discussion thereon, at the last New England meeting.

Mr. Cantine—I think the best plan would be to pump the water out of it, and then repair it.

The President—That is about what Mr. Sherman said.

The Secretary—That is, the best way to fix it is—to fix it.

The President—We will take up the question—

"*Would it be economy for a gas company with only* 1,500 *consumers to do its own meter repairing?*"

I will ask Mr. McIlhenny to reply to the question.

Mr. McIlhenny—I suppose there are some who have asked these questions who really know more about them than do the people who are expected to answer them. In my own case you might think I was talking "shop" if I were to express my honest conviction with regard to this matter; and some may be uncharitable enough to say that "Where self is in the balance weighed, the scales are hardly right adjusted." But since you ask me this question, in all sincerity I must answer "No," regardless of what the impression may be against it. I do not think it would be economy for a gas company with 1,500 consumers to repair their own meters. If we suppose that even 5 per cent. of those meters need repairs in a year, that would be 75 meters; and it would not be worth while to employ a skilled mechanic—none other ought to be employed—to repair that number. You could by sending them to any meter shop in this country get them repaired by men who understand their business thoroughly, and who have all the appliances necessary for properly cleaning them, examining and testing them, and get the work done well for less money than you could hire a man to do it. As a rule, it is always better for people to live and let live. It is always better for corporations especially to give people who are their friends a chance to work. One of the most prominent railroads in this country undertook at one time to run their own sleeping cars, their own express, and their own telegraph; but the disadvantages and disasters of that course very soon became apparent. If a gas company has enough meters to justify it in keeping a good man and paying him good wages, it will do; but you must know that these meter repairers earn very large wages. If I were to tell just how much they make per week it would surprise you. If you were to pay a competent man at the current rate for repairing those which need it per year, out of 1,500 meters, you would find it less expensive to buy new ones. Even if 10 per cent. gave out, it would not pay his wages. You could get them repaired for less, by sending them to any shop in the country, than the amount that you would have to pay him; and you could get it done better. And besides that (I do not attach any great importance to this part of my belief), you would have the argument that, the meter was made and repaired by some one else. The law creates an office under which examinations are made of weights and measures. The inference is that the law will not trust you to be the adjuster of your own weights and measures, but a sworn officer does it. That takes away from you the moral and legal responsibility, and necessity of explaining that you do not adjust them yourself. And it is the same with gas meters. The gas meter is a most important thing between you and your consumer. It is the arbitrator. It is something for you to be able to say that you did not make it, or repair it, and then you cannot not be charged with adjusting it. If any one else adjusted it it is their fault not yours if it is wrong. But, simply as a matter of economy (which is the question proposed), I can say it would be *bad economy* for a gas company having 1,500 meters to hire a man to repair them. I am satisfied you could hardly employ a man that could do any other kind of work; and unless you had a much larger number of meters, it would not pay you to do it. I believe any gas company in the country would save money by sending their meters for repairs to a regular meter company. I may be charged with having self in this matter, but do not believe I have. I have looked into the question carefully in the interest of a large gas company repairing their own meters, and ascertained what it would cost them to send for repairs to some regular establishment. I found they were paying more than we would have charged for doing the work.

Mr. Cantine—A man who claimed to be an expert meter repairer came to me once. He had some strings and a bundle of leather that would do for the diaphragms. I fixed him up a place and he went to work and repaired 10 or 15 meters for me. He said he had a little improvement on all the meters that were in use—that this little check which drops down over the arm was a nuisance and that it had better be removed. The result was these meters would go all right if kept continuously moving on; but if they happened to stop, they were likely to go the other way.

The President—Is any gentleman prepared to answer this question—"*What is the igniting temperature of common coal gas?*"

The Secretary—I can say I have lighted a gas jet with a red hot poker. If you can tell me how hot a red hot poker is, perhaps I can answer the question.

The President—What shade of red?

The Secretary—A light cherry red.

The President—We will now turn to the question—

"*What is the least grade per* 100 *lineal feet practicable to drain gas mains?*"

Mr. Printz—I asked that question for the purpose of learning if any of the members had been compelled to run drainage as low as I had. Last season I was compelled to run a main where I had to hold it as close as two inches to the 100 feet. Of course I had to be very careful in securing that drainage to get an even grade, so as not to have any pockets. We have had no trouble with the drain laid that way.

Mr. Nash—I have never had an experience in laying mains as nearly level as that, but judge that if the pipe is properly laid, and with a good foundation, there would be no bad results.

The President—Then we will consider that Mr. Printz has answered his own question. The next question is—

"*When a mixture of coal gas and air is exploded, how much does the volume of the resultant gases exceed that of the original mixture?*"

Mr. Douglas—The maximum explosive force is obtained by a mixture of 12 to 1: but the volume would depend upon whether that was exploded at a constant temperature, or whether it was cooled.

The President—The question is not very definite, as it does not give the proportions.

Mr. McIlhenny—The gas engine men ought to be able to answer that question.

The President—They could if the question was complete, but it is not.

The Secretary—I suppose the propounder of the question meant when the gas and air were mixed in the proportions named by Mr. Douglas.

The President—It would be necessary to know what temperature it was taken at. The next question is—

"*Is there any steam heating apparatus known in which illuminating gas can be used for fuel at not too great a cost, when gas is figured at cost in the holders?*"

Perhaps Mr. Butterworth can say something on that.

The Secretary—I would answer it negatively, as to the ordinary consumer. Some with small houses and large incomes could afford to use it.

The President—We will consider that question answered in the negative.

Mr. Hayward—I would like to ask Mr. Butterworth if the report of his inspector, as to the use in Columbus of illuminating gas for fuel purposes, did not prove the fact that it was cheaper to use steam or hot water than it was to use a furnace.

The Secretary—I am really not able to answer the question, because the two furnaces which were used were not in the same house. We tried a steam-heating furnace in one house, and an ordinary coal fire furnace in another. It seemed to me there was not very much difference. The house now being heated with our gas has a steam heating furnace, and they are continuing that method at present. All the rest have practically abandoned the use of gas in their furnaces. That house, which is a rather large one, is occupied by some elderly ladies who do not like to make a change from gas heating in the winter time. Besides, they have an interest in a gas works in Indiana, and perhaps that has something to do with their willingness to continue the experiment longer than anyone else.

Mr. McCook—Is that the one where the fuel gas cost $74.

The Secretary—Yes.

The President—I think Mr. Tayler has had some experience in heating with hot water. Has he any data that he can communicate?

Mr. Tayler—I do not know I have the figures applicable in mind. I heat my office and shop with hot water, which is heated by gas. I heat the first floor, of three rooms, about 15 feet square—a stairway in one of them causes considerable of the heat to go to the next floor—and the shop is 15 by 30 feet. I have paid no attention of late to it, but a year ago I was running between 1,500 and 2,000 feet of gas per day. This year I have no doubt I have used more. I probably use over 2,000 feet per day of 24 hours.

Mr. Cantine—Taking such hot water generators as we saw at the exhibit here last night, and at Toledo last year, I am somewhat of the opinion that a system of hot water heating such as they suggest might be made to work with gas, and very cheaply. The question of circulation is one of great moment in hot water heating. If the circulation could be kept up I am of opinion that it would be as cheap a heat as any other.

Mr. Timmons—I have had occasion to use our gas under a hot water heater—it was where they had been using the natural gas and the gentleman did not like to change; but the natural gas would fail occasion-

ally, so I put on a meter and connected with our gas. That heated the house very nicely for five or six hours—the length of time that the natural gas would be turned off. He used about 100 feet of gas per hour We could heat it with either direct or indirect hot water heat—that is, with water circulating in the radiator in the cellar, and from there up into the building it was indirect heat, from hot air. It worked very successfully.

The President—We will consider the next question—

"*What is the average per cent. of sulphur in Lima crude oil, and is the sulphur in the form of sulphureted hydrogen or bisulphide of carbon?*"

I have never seen an analysis, I think, of the Ohio crude oil. I do not think the percentage of sulphur is very high. I think the form in which it is combined is the objectionable feature, and the one which gives it a strong odor. The large percentage of sulphur is in combination with carbon, and not with hydrogen; but just in what proportion I do not know.

Mr. Hayward—I would suggest, from the smell of it, that the sulphur in Lima crude oil would seem to be in the form of sulphureted hydrogen.

The President—It is true that there is some sulphureted hydrogen there, but I have never understood that the larger per cent. of the sulphur was in that form. If it were in that form it could be readily disposed of. There is a pretty good sprinkle of coal gas men here who should be able to answer the next question—

"*What are the causes of the lowering of the candle power of gas when you are charging as usual and using the same kind of coal and purifying material?*"

The Secretary—We occasionally may have had a lowering of our candle power under the circumstances described in this question, due to the fact that our exhauster ran a little too fast for a few minutes, through some accident or other reason.

Mr. Printz—Perhaps it was due to the change of heats at the retorts. A decrease or increase of temperature produces a richer or poorer quality of gas, and that would readily change the candle power.

Mr. Penn—I do not think either answer is satisfactory, because I have known of cases where neither of these causes operated and still the candle power was very poor. I would like to have some other explanation.

The Secretary—I will ask Mr. Penn how long the candle power remained low?

Mr. Penn—For several days. I used cannel to enrich with afterwards. I had not been in the habit of doing that. We used the best coal, and had had no trouble in keeping our candle power up to the standard.

The Secretary—Perhaps they ran in some inferior coal on you.

Mr. Penn—Then the cannel coal ought to have brought that up. I had been using some grindstone grit for purifying, and thought perhaps that might have something to do with it.

The President—Was the coal you used freshly mined?

Mr. Penn—Yes; we get a carload a week regularly, freshly mined. It was kept dry.

The President—I had an experience once with coal which came fresh enough, but it was pier coal—taken out of the piers in the mine, which had been standing there for a long time—and it yielded a very low quality of gas as to illuminating power. A very high percentage of cannel had very little effect on the illuminating power. I had one experience with coal which had been in stock for sometime, and while it had been stored well and was in good condition, it must have gone through a slight process of heating, so that the light oils had disappeared from it. While it made almost the same volume of gas, it was deficient in illuminating quality. I had another experience in changing the quality of gas, when enriching with naphtha. We had given up the use of cannel, and provided special means for making naphtha gas to enrich coal gas with, and during the time we were making the change, and the gas making apparatus was out of use, we resorted to the use of oil in the retort introducing naphtha there. A fair quantity of it was used, but the gas was far from uniform in its illuminating power, and it finally got quite bad. There was clearly no way of accounting for it. It occurred to me that possibly the oil gas was not being properly made—that the naphtha was not all being made into gas, but that some of it was dissolved out in the coal gas, and the hydro-carbons eliminated, which would have been illuminants in the coal gas if I had not used any naphtha. I can say I gave up the use of naphtha temporarily, and for a day or so the quality of the gas was poor, but, after a few days, when the naphtha which was setting about in the works had become saturated with the light hydrocarbon in the gas, and the gas was allowed to go on without being acted on by the naphtha, the illuminating power came up, and we had uniformly better gas than our gas averaged before we used the moderate quantity of naphtha.

Mr. Penn—Our trouble lasted for several days. We had a great deal of complaint.

The Secretary—How was your yield during this experience?

Mr. Penn—About as usual.

Mr. Cantine—Are you certain you were not working your exhauster on a light seal, and taking in a certain amount of air? That occurs frequently. It happened with us on two occasions.

Mr. Penn—Did not that give your gas jets a blue blaze?

Mr. Cantine—No; it gives that rim around the flame—dark with only a small circle of light. That was caused by dropping the seal too low. The stand-pipe had been giving us trouble, and the men drew off too much water from the hydraulic main, and did not replace it at the same height. Then the operation of the exhauster took air in with the gas and spoiled all that we were making.

The Secretary—Possibly Mr. Cantine's suggestion may be the solution of Mr. Penn's peculiar experience. There possibly may have been a leak in the pipe somewhere between the exhauster and the retorts, admitting air, which was drawn in for some days, and then was stopped accidentally, without its being discovered that that had been the trouble all the time.

Mr. Penn—I could not detect any impurity in the gas.

Mr. Cantine—It would not produce any impurities. It would be as pure as the air is.

The President—We will proceed to the next question—

"(*a*) *What is the best material for roof of retort house, and how should it be put on?* (*b*) *For boiler houses?* (*c*) *For the engine and dynamo room of an electric light plant?*"

Mr. Printz—We have two retort houses, one having an iron roof (an iron frame covered with slate), while the other is just an ordinary wood frame, roughly sheathed with pine boards, and slated like any ordinary roof. The iron one has been on that portion of the house since 1849. We have had occasion, I think, three times during that period to relay the slate. Originally the slate was put on with lead nails But the last two times we have used copper nails. The frame appears to be just as firm as ever, and I use it for hanging my tackle to. The other end of the house, where we have the rough board frame, has had the roof on since 1853. The only trouble we have with it is that occasionally the nails are eaten off, when we have to go over the roof and relay the slate.

Mr. Cantine—I know how not to put a roof on an electric light plant. I built one once—and I could get up a shower in there on very short notice. I built a new building, put on the roof, slated it, and it was all right in warm weather; but when cold weather came the heat of the room went up to that slate where it condensed and produced a very nice shower on the dynamos. We had to put canvas over the dynamos to keep the rain off. If anyone wants a good roof, let him use boards covered with paper, or anything that is non-condensing, and then slate it.

Mr. McCook—How about felting under the slate?

Mr. Cantine—That is first rate; but any kind of paper will do. That which has no tar about it is just as good.

Mr. Penn—I would like to ask whether the heat of a retort house does not cause the slate to break in the winter time, by contraction and expansion.

Mr. McCook—You laughed about Mr. Cantine's roof and at his tents. We built a roof also; but not of slate. We put on a corrugated iron roof; and I will "back" it to shower against brother Cantine's at any time. (Laughter.) We have tents over our dynamos now. That roof is no good at all. The condensation from it causes rain there all the time. The dynamo room is ceiled with tongued and grooved boards, and nearly all the garret above is boarded over; and yet—how the water leaks down there!

The Secretary—I would advise Mr. Penn to put a board roof on his retort house. It don't corrode and don't give any trouble. We have one on ours and it is very satisfactory. Put on the boards with a layer of paper between them. First a layer of boards, sheath all over with tar paper or felting, and then break the joints with more boards.

Mr. Printz—Down below our gas works they are puttiug up a new electric station. Over their dynamo room they have built a roof, in the first place, as if they were going to slate it, then they started with boards, tongued and grooved and laid lengthwise and down the roof, then papered on the top of this, and then slated, and I think their roof is as dry as bone.

Mr. Wilkiemeyer—I have a slated roof on my electric light building. I put the slate roof on as I would on any ordinary house, but the pitch is very steep. I used a good quality of paper, and then ceiled the whole room. It is perfectly dry.

Mr. Penn—In addition to the way Mr. Wilkiemeyer has his arranged, I have ventilation through the center by means of a tower. I keep that open and have a perfect circulation of air, which I think has a tendency to keep things dry.

Mr. McCook—Just over and at about the center of our dynamo room are two bull's eye windows, one on either side, probably about two feet in diameter. But still the shower continues.

Mr. Nash—I have a ventilator in the dynamo room—the boiler room and the dynamo room are the same in our case—and we have never had any condensation, although the roof is simply a plain shingle roof.

The President—The building of the Electric Light and Power Company at Toledo was roofed with a frame made of ordinary 8 by 12 timbers, and then sheathed over with flooring, the slate on top of that, and we have had no indication of moisture from the inside. This same subject was taken up and treated at the Kansas City meeting of the National Electric Light Association a year ago, last February, in a paper on the subject of "Improved Electric Station Construction." I am sorry to say I do not recollect just what was recommended there for the roof cover, but the deposit of oil and condensation of the steam, depositing moisture on the roof, was one of the items taken in the account in considering what roofs should be constructed of. I would suggest to any members who feel an interest in this matter that they refer to the proceedings of the National Electric Light Association, at the February meeting, 1890.

Mr. Penn—I would like to ask, with regard to the retort house roof, what kind of material should be used for the valleys in a slate roof?

Mr. McCook—Copper or lead, if you have money enough to buy it.

Mr. Printz—I will answer that by saying we always use lead in cases of that kind. We use lead in all the valleys about the gas works.

The President—The next question is—

"What is the cause of lava tips fouling when the gas shows clean by the usual test?

Mr. Faux—I have had a good deal of experience with this trouble and have not yet been able to determine what the cause is. I did not propound the question, but am anxiously waiting for an answer to it. I have half made up my mind that it is the bisulphide of carbon. I think the lava tip has a certain affinity for the bisulphide of carbon. I make no test for the bisulphide of carbon, but believe it is there, and believe it is that which fouls the tips.

Mr. Printz—I think at the Dayton meeting of this Association I read a paper on the cause and prevention of the stopping of burner tips. At that time we came to the conclusion, as Mr. Faux has said, that it was due to the bisulphide of carbon. In that paper I explained how we had made certain tests. We had taken out all the impurities, as we supposed, and, as this question suggests, our gas showed no impurities by the usual tests. Thinking it might be owing to the presence of the bisulphide of carbon, we made a test for it and found a small percentage of that impurity in the gas. Of course that was not determined by the usual test. To satisfy ourselves that the lava tips at a certain temperature would cause this bisulphide of carbon to deposit, we at that time tried an experiment conducted in this way: We made small pellets of dry clay, placed them in a glass tube, then passed gas through the tube, heated the tube so as to heat the pellets up to a fair temperature, and found that the same deposit which we had discovered on the tips of the burners was deposited also on these clay pellets. Afterwards I took the same gas, burned it in the tips, and found we would have the deposit. Then I took other gas, removed the bisulphide of carbon, burned it, and did not have that deposit. I think yet that the trouble is caused by the presence of bisulphide of carbon, and have not yet been able to eliminate enough of it from our gas to remove the trouble. We still have the same trouble with our burners choking up.

Mr. McCook—I think the Bray burner does not do it to the same extent as the ordinary lava tip burner.

Mr. Printz—I find that a fish tail burner, either of the Bray or of the ordinary type, does not close up as the bat's wing burner does.

Mr. Faux—It is a question in my mind whether the Bray burner is made out of clay. I think it is steatite or soapstone. I have never found that a soapstone burner had any affinity for that stuff. I have had no trouble from the Bray burner.

The Secretary—Was this a black deposit?

Mr. Printz—Yes. I had a number of burner tips that were just lined over the top, or right around the top, with a fringe-like substance. Examining it with a glass, it looks like a brush.

The Secretary—Could you not have collected enough to submit to a chemist for analysis?

Mr. Printz—I might have done so.

The Secretary—I do not know what color the solid bisulphide of carbon would be, but did not suppose it was black.

Mr. McCook—Don't you have any trouble at Columbus?

The Secretary—I don't remember having any.

Mr. Graeff—Our Philadelphia gas never causes any stopping of the tips.

Mr. Faux—I think they use lime very largely in their purifying boxes. Working their lime as strong as they can get it, they have very little trouble. I use the iron sponge, and I am troubled with the fringe on the burners.

Mr. Graeff—In Philadelphia they are using lime and iron sponge, but they do not get that deposit on the tips. I am in a section of the city where they are using the mixed gas, and I have noticed no trouble whatever with the tips.

Mr. Printz—One of the journals a short time ago had a communication from an expert chemist of Philadelphia, stating they had had trouble there from the burners choking up because of the impure gas. He gave as a reason that certain impurities, of which the bisulphide of carbon was one, were produced by the use of certain coals—it was stated that in Philadelphia they had been compelled, owing to the fact that there had been strikes among the miners, to use this poorer grade of coal—but that as soon as they could get back to the use of good gas coal this trouble would disappear.

The Secretary—I think that statement was made by Dr. Cresson.

Mr. Graeff—That was a temporary trouble—I am referring to the general run of gas in Philadelphia. We do not brag much of the gas, but it does not clog up the tips.

The President—What coal do you use, Mr. Faux?

Mr. Faux—Pittsburgh coal. I think Westmoreland coal is practically free from that trouble.

The President—Mr. Printz, do you use native coal?

Mr. Printz—Yes.

The President—I remember an article stating an experience on the other side of the water. The bisulphide of carbon is an impurity that they have to take out of the gas over there. They use a strong lime. Mr. Somerville (I think it was), himself an old gas engineer, used the oxide of iron for removing the bisulphide of carbon, and this was spent oxide, containing above the average percentage of free sulphur. His theory was that the free sulphur would be dissolved by the incoming gas and reduced to a liquid, and it would run further down and be deposited. He ran it through this spent oxide for a number of months, perhaps more than a year, and the gas came out practically free from bisulphide of carbon. The bisulphide has never given us any trouble, because of our use of oxide of iron purification, and the fact of the oxide of iron having more than 30 per cent. by weight of free sulphur deposited in it. One other thing, I think, has been a factor in stopping up burner tips, and that was the vapor of oil in the gas—improperly made oil gas—in water gas. In our early experience that was more common than now. I remember reading in some of the old issues of the AMERICAN GAS LIGHT JOURNAL early experiences with Lowe water gas in this country, exhibiting pictures of burners having a fringe of carbon deposited in the tips. In those days it was the practice in making water gas to make very long runs, and the latter portion of the runs would be simply oily vapors; there would not be heat enough to make them into gas at ordinary temperature. The burner tip would become very highly heated, and the heated tip would deposit carbon, much the same as Mr. Cantine described yesterday as deposited in his retort. We have had no trouble with carbon deposit on the burners, because of our having a large apparatus and being able to keep the necessary amount of heat in the oil to make it into gas at ordinary temperatures. Some of the stations near our town, which have smaller apparatus and which make comparatively longer runs than we do, have had plenty of that trouble although they are using the same materials that we are.

Mr. Faux—I found the same trouble when I used benzine of 68° or 70° gravity, but not enough to cause me any inconvenience. As I went along the street I might see one burner here and another perhaps half a square below which showed deposit. I think that the trouble comes from the coal more than from anything else. I found it the same with 68° or 70° gravity benzine as with any light oil.

Mr. Hayward—(To the President)—In your explanation of that process, where did you say Mr. Somerville put his spent oxide?

The President—My recollection is that he used an old gas tank, or scrubber. It was a very crude arrangement, but accomplished his purpose. He used the free sulphur which had been deposited in the revivification of the oxide as an absorbent of the bisulphide of carbon from the gas.

VOTES OF THANKS.

On motion of Mr. Cantine, the thanks of the Association were tendered Mr. Printz for his services in connection with the meeting and for the badges which he had furnished the members.

A vote of thanks was also passed to the President and to the Secretary. The meeting then adjourned.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

IT looks as if Superintendent Tracy, of the Alton (Ills.) Gas and Electric Light Company will have but a short holiday this summer. As said before in the JOURNAL, an important scheme of enlargement has been worked out by President Underwood, and in completion thereof the following pipe contracts have been entered into: Messrs. Shickle, Harrison & Howard, of St. Louis, are to furnish 2,500 feet of 8-inch cast iron pipe, and the National Tube Works, of St. Louis, will supply 600 feet of Converse joint pipe. This pipe is to replace 3,100 feet of 4-inch pipe, and the old lines will be put down in sections of the city not now lighted by gas. Bids are to be entertained for an entirely new electric light plant, based on a capacity of 100 arc and 650 incandescent lamps. New buildings will be erected also. The increase in output at Alton since the first of the year is almost 25 per cent. over that for the corresponding period in 1890. On the 1st inst. the Company had 13 orders for gas stoves on its books, the same to be in position by May 1st. From all of which it will be seen that Messrs. Underwood and Tracy are alive to the lighting possibilities of their pretty city.

MR. J. A. MCCOLLUM, Superintendent of the Riverside (Cal.) Gas Light Company, under date of March 29, writes: "We are alive and doing well. Have had a very good winter season so far, and have laid 16 blocks of pipe, ranging from 2-inch to 6-inch. We put the price of gas at $2.50 per 1,000, a reduction from $4. The city is growing very fast, and we are on the go to keep up with the advance. Over 100 gas stoves were placed this winter. We make gas under the McCollum & Burt patents, and our experience is that the results claimed for it can be relied upon."

THE Carondelet (Mo.) Gas Company will shortly take up the supply of incandescent electric lighting in its St. Louis district. A separate plant will not be necessary, arrangements having been made to secure

the necessary current from the station of the St. Louis Municipal Company.

ABOUT a fortnight ago Mr. and Mrs. John Roemer, of Wheeling, W. Va., appeared before the Board of Gas Trustees and demanded payment for damages occasioned their property some weeks ago through an explosion of gas—their residence is located at Twenty-first and Main streets. Complainants asserted that as the gas escaped into the cellar through a faulty service pipe from the street, the gas works officials are chargeable with negligence, hence it is a case where recovery can be insisted upon. The Board held that the leak was in the house services, at a point beyond the meter outlet, which put the escape and its consequences outside the control of the works. The Roemers will appeal to the courts.

MR. JAS. BURNES, JR., has been appointed an auditor in the Bureau of Gas, Philadelphia, vice Mr. Edward O. Coxe, resigned.

THE Pacific Gas Improvement Company, San Francisco, has increased its monthly dividend rate from 4 to 6 per cent. per annum. Under the influence of this the Company's shares moved up rapidly from 76¾ to 81½.

MR. FRANCIS L. BURNHAM, who has been with the Lowell (Mass.) Gas Company for something like four years, is now with C. L. Fuller, C.E., of Boston.

THE Singer Sewing Machine Company's mammoth factories at Elizabeth, N. J., will hereafter be lighted with gas from the mains of the local Metropolitan Gas Company. Heretofore the gas supply was manufactured on the premises. In order to reach the Singer works the Gas Company was obliged to put down 1,600 feet of mains.

WE understand that on Tuesday last an agreement was indorsed by the shareholders of the Saco and Biddeford (Me.) Gas Company under which their franchises, property, rights, etc., are to be sold to the York Light and Heat Company.

IN the matter of the petition of the Easthampton (Mass.) Gas Company to the Board of Gas and Electric Light Commissioners, which took on the form of an application to engage in the business of generating and furnishing electricity for light and power, the following is submitted as a summary of the hearing and the decision of the Board: "A public hearing was held at Easthampton, February 6th last, in accordance with notices served on the town, the petitioner, and the Peoples' Electric Company. The Companies were represented by their presidents, and the town by one of the Selectmen, who made no objection to the granting of the petition on the part of the town. A considerable number of citizens were in attendance, one or two of whom were heard in opposition to the proposed consolidation. The opinion generally expressed by those present was in favor of it, and all expressed a desire for the continuance of the electric lights in the streets. From the evidence it appeared that the capital of the petitioning Company was $30,000, and that of the Peoples' Electric Company, $5,000. The latter Company was supplying about 35 arc lamps for lighting the streets of the village, which comprises a population of about 3,000. The Electric Company owned neither land nor steam plant, but hired its power. Both Companies have the same clerks, and the same men constitute a majority of the directors in each. The belief expressed by them that the Gas Company could more economically manage the electric lighting rates rests, in the opinion of the Board, on a sound basis. The electric business is small and inadequate for the proper support of a separate company. From inspection of the premises it appears that the gas works were suitably situated with vacant land adjoining, available for an electric plant. Some fear was manifested that in case the petition should be granted the price of electric light would be raised and that the Gas Company would not be willing to supply incandescent lights. The petitioner, however, having given assurances at the hearing that the rate would not be increased, the Board saw no reason why the price should be raised as the result of consolidation. If it believed such to be the end sought, the petition would be dismissed. Attention was called to the statutes which enable the Board to fix the price of light, and to the provisions under which it would have the power to require the Consolidated Company, as it can now the separate Companies, to supply gas and incandescent as well as arc lights to those justly entitled to them. There was some difference of opinion among the Directors of the Gas Company upon the advisability of increasing the capital stock in case of consolidation. It was admitted that the credit of the Company was good and that it could borrow at a low rate of interest. Its last dividend was at the rate of 8 per cent. Well aware that an undue enlargement of capital in such cases is likely to obstruct the benefits which otherwise might result from a union of the Companies, the Board intimated that its action would depend in some degree upon the amount of capital proposed, and requested more definite information after further deliberation on the subject by the Company. The votes of the stockholders which were put in evidence in reference to engaging in the electric lighting business and obtaining authority so to do, were faulty and not sufficiently explicit to meet the requirements of the statute. Furthermore, the Companies had entered into an agreement in writing, such as the Board in previous cases had deemed an essential condition, setting forth the terms of the consolidation, although it appeared that they had come to a verbal understanding. The hearing was formally closed, but the consideration of the case was postponed to allow the Companies time for such further action as they might deem expedient. It now appears that the Gas Company has held another meeting and passed the requisite vote. The Directors have decided that it is inexpedient to increase the capital stock and have authorized the treasurer to borrow the funds necessary to purchase the existing electric plant. A building contract has also been executed for the sale and transfer of the franchises, property and shares of stock of the Peoples' Electric Company to the Gas Company. In view of these additional facts and under all the circumstances of the case, the Board believes the petition should be granted, and so orders."

THE Citizens Fuel Gas Company, Terre Haute, Ind., claims to have 200 consumers on its books, who maintain a total of 1,000 fires, equivalent to a daily consumption of 120,000 cubic feet of gas.

BY-THE-WAY, the practice of the Jackson (Mich.) National Gas and Fuel Company is to oblige its "gas makers" to remain on duty for 12 hours at a stretch.

JUDGING from the present outlook in the Massachusetts Legislature, the measure to enact a general bill permitting the cities and towns of the State to engage in the manufacture and sale of gas and electric currents for lighting purposes on municipal account will not become a law this year. In any event the Committee on Manufactures who have been considering the subject, have, by a vote of 6 to 4, reported that sort of legislation inexpedient. The minority of the Committee—Senator McDonald, and Representatives Moriarty and Childs—will prepare a substitute bill, and while the latter may be successful in the lower branch, the opponents of the measure will concentrate their efforts when the scheme occupies the attention of the Senate, with every likelihood now that they shall succeed.

IN connection with this, the following (from a source usually well-informed) will be of interest: "It was thought early in the session that a bill granting cities, etc., in Massachusetts, the right to make and sell gas and electricity would be passed very readily, but it now appears that there is very strenuous opposition. A great deal of influence is being brought against it. The friends of the measure are talking of taking some such course as was pursued on biennals—to call a caucus of all those who have committed themselves in favor of the change, and to follow this up with public meetings. A majority of the members, it is said, are on record as favoring this change, and much interest is manifested in seeing how many of them will now vote as they pledged themselves to do when their election was hanging in the balance. The friends of the measure claim that public opinion is more strongly than ever in favor of the change, which assertion is emphatically denied by its opponents. The report of the Committee that investigated municipal gas plants in other cities is anxiously looked for."

MR. J. P. WHITTIER, the well-known gas works mason and contractor, reports that he is very busy. Among the contracts now held by him are the following: Extensions to the Williamsburgh (N. Y.) plant to hold the Loomis plant recently ordered; a meter room and boiler house for the Peoples Company of Brooklyn, also, foundation for steel tank for same Company, and a shop (105 ft. by 36 ft.) for the Logan Iron Works Company of Brooklyn, the proprietors of which propose to go into gasholder construction on a large scale.

MR. E. C. JONES has resigned his positions as Assistant Engineer of the Boston Gas Light Company and Assistant Superintendent of the South Boston Company, in order to accept a more congenial and lucrative berth with the San Francisco Gas Light Company. Mr. Jones will act as Assistant Engineer in his new field of duty, under the direction of the President-Engineer, Mr. J. B. Crockett. It may savor of selfish-

ness, but we are sorry that Mr. Jones is about to locate himself on the other side of America, although, of course, there can be only one answer by a sensible young man to a call that carries promotion and emolument with it. Further, we are sure that he will keep in touch with the Eastern fraternity, of which he has been so active and honorable a member. Mr. Jones goes to San Francisco on the 1st prox.

MAYOR EDWIN S. STUART, of Philadelphia, has appointed Mr. James H. Windrim to the position of Director of Public Works, succeeding General Wagner therein. The new appointee resigned the berth of United States Supervising Architect in order to qualify for the duties of his present berth. While astonishment is manifested in some quarters over the appointment, the bulk of sentiment endorses it.

THE Dallas (Tex.) Gas Company has determined to reduce the rate of gas consumed for cooking and heating purposes to $1.50 per 1,000 cubic feet—probably the cheapest gas rate in the Lone Star State. The Company will sell the gas stoves at cost, and Superintendent Enfield's faith in the likelihood of the willingness of the residents to avail themselves largely of the Company's liberality is so strong that he has "put several hundred gas cookers, etc., in stock." As Enfield generally is not far wrong of the mark, we expect soon to hear that he has given the gas stove makers additional substantial orders for their "goods."

AT the annual meeting of the shareholders in the Cincinnati Gas Light and Coke Company, to be held on May 4th, a proposition will be voted on to increase the capital stock from $6,500,000 to $7,000,000. The increase is to make capital representation of the Globe Rolling Mill property, mention of the purchase of which by the Company was recently made in these columns.

SUPERINTENDENT JOHN GILCHRIST, of the Woburn (Mass.) Company, who has been under the weather for some time, is on the high road to permanent recovery.

AN injunction has been issued restraining the Oxy Hydrogen Gas Company, of Wilmington, Del., from laying its pipes in the streets of that city. This is the first step in what promises to be a protracted series of proceedings in the courts.

EARLY this month Director Wagner, of the Department of Public Works, Philadelphia, submitted the following comparative statement of the operations of the Gas Bureau for the corresponding quarters of 1890-91: In the first three months of last year the output of gas amounted to 969,441,000 cubic feet—of which 633,792,000 cubic feet were made in the city's works, the balance (335,649,000 cubic feet) having been purchased under the contract with the Philadelphia Gas Improvement Company. For the first three months of 1891 the quantity of gas made equalled 652,025,000 cubic feet, and the quantity purchased is returned at 365,037,000—a total of 1,017,062,000 cubic feet; or an excess over 1890 of 47,621,000 cubic feet. The receipts are thus returned:

	Receipts.	Expenditures.
First Quarter, 1890.....	$1,217,391.39	$722,225.25
" " 1891.....	1,291,715.06	778,574.58
Differences.....	$74,323.67	$56,349.33

The profits in 1891 were $513,140.48, as against $495,166.14 in 1890.

THE gas works at St. Augustine, Fla., were badly damaged by fire on the morning of Monday last. The loss is not far from $15,000.

ANOTHER hitch has been brought about in the proposed consolidation of the gas interests of Rochester, through the action of one George E. Fisher, a stockholder in the old Rochester Company. The meeting at which the merger was to have been effected was set for the 3d inst., but it came to naught because of an injunction issued at the instance of Fisher. The latter was, in 1888, interested in a scheme to supply natural gas in Rochester, through and by the assistance of a corporation known as the Rochester Natural Gas Company, in Pennsylvania, as the Natural Gas Company (Limited), in New York State, and as the City Gas Company, in Rochester, and he now claims that at least one of the artificial gas companies concerned in the proposed consolidation made to him certain pledges that have not been carried out, wherefore, he asserts, if the Company's identity is destroyed he will be put at great loss, etc. Although a temporary injunction was issued, there is little whereon to found the belief that it will not be speedily vacated or that the proposed consolidation will be permanently hindered. The affair, so far as Fisher is concerned, has a peculiar look. When the merger shall have been effected, we understand that a substantial concession in gas rates will be made. The present rate is $1.60, and we are of the opinion that the cut will not be less than 20 cents per 1,000.

MR. J. R. TODD, Superintendent of the Middletown (N. Y.) Gas and Electric Light Company, writing to us under date of April 7th, in explanation of how he reduced the back pressure of his purifying boxes—a subject that provoked an animated discussion at the Zanesville meeting of the Ohio Association—says: "On the bottom row of trays in the boxes I placed about six inches of broken coke, and on the next row I put canvas bags—*double*—to prevent the sponge from mingling with the coke. I also have one layer of lime on top of the sponge in each box. During the past winter I have had considerable trouble with back pressure from the boxes. I tried various ways and means to reduce it, with the result that partial relief followed, partial in that it was only temporary. After each interval of relief the monster returned, seemingly stronger than ever, until the climax was reached in the month of February, when the pressure would show inside of eight or ten hours from the time that a box was changed, which operation would have to be performed again at the end of the second day. Thoroughly perplexed I examined carefully the material taken from one of those short term boxes, and at first sight no reason for its giving out was discerned, but a peculiar glaze on the bags caused me to take out my pocket-knife and run a blade edge over the canvas. I found they were covered with a heavy, greasy substance, and concluded I had found the monster, and that in the union was where his strength lay. I ripped the bags open and relaid them *single*, continuing the process until the fourth purifier was changed, on March 8th. That purifier is running to-day—April 7th—and the pressure remains the same as when the gas was turned on. That is, three inches, or about three-tenths over the pressure from the holder."

THE City Council of Columbus, Ohio, has passed the ordinance allowing the Central Ohio Natural Gas Company to raise its rates on fuel gas to ordinary consumers to 25 cents per 1,000 cubic feet. The old price was 10 cents per 1,000, but repeated demands on the part of the Company to be permitted to raise the rate to that now granted having been refused, the Company shut off gas from the consumer's services.

THE Honorable George Maxwell, President of the Rockville (Conn.) Gas Light Company, died at his home in that city on the 2d inst. He was largely interested in wooolen manufactures, and served, a term each, in the upper and lower branches of the Connecticut Legislature. He was born at Charlemont, Mass., July 30, 1817, and settled permanently in Rockville in 1843. He was universally esteemed for his business capacity and rugged probity.

JOHN W. STELWAGON (who trades as Joseph Stelwagon's Son), of Philadelphia, has filed a bill in equity against the city, Mayor Fitler, Director Wagner and M. Ehret, Jr. & Co. Complainant in his bill asserts that some time ago bids were solicited by the city for the tar from the gas works for terms of one, three and five years, and that the contract has been awarded to the firm of M. Ehret, Jr. & Co., at 35 cents per ton of coal carbonized, the contract to last for three years. Complainant avers that he bid at the rate of 31½ cents for a term of one year, or for 36½ cents for either a term of three or five years. That in this way his bid for the same period of time as that of his competitor, and for a term of five years too, was 1½ cents over the bid of the successful applicant. Stelwagon, therefore, contends that the Department of Public Works has acted in a manner greatly prejudicial to his interests in not awarding him the contract, and asks that the court may grant an injunction restraining the defendants from consummating the contracts, and also decree that the right to purchase the coal tar for the next three years be given to him, according to the terms of his bid.

THE handsome building occupied by the Newark (N. J.) *Advertiser* was recently destroyed by a fire that was caused by electric lighting wires.

THE Bellevue (Ky.) Gas Company may go into the furnishing of electric lighting currents. The authorities are at the back of the agitation.

MR. JOHN ATKINSON, who for several years acted as Manager of the Peoples' Gas Light and Coke Company, Chicago, died in that city about a fortnight ago.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 Wall St., New York City.

April 13.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	98½	99
Central	500,000	50	90	100
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	115	117
Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	119	120
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co —				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	117	120
Citizens	1,200,000	20	88	90
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	130	132
" Bonds	300,000		10[illegible]	105
Peoples	1,000,000	10	89	91
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	100	105
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	134	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co. —				
1st Series S.F. Trust	7,000,000	1000	—	87¼
2d " " "	3,000,000	1000	74½	76
Bay State Gas Co. —				
Stock	5,000,000	50	63	64
Income Bonds	2,000,000	1000	95½	—
Buffalo Mutual, N. Y.	750,000	100	105	110
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	-	
Chicago Gas Company.	25,000,000	100	47¾	47⅞
Chicago Gas Light & Coke Co. —				
G't'd Gold Bonds	7,650,000	1000	87	88½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	98
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	94	98½
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	6,500,000	100	204	205
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			92	100
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	47½	48
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn.	750,000	25	102	108
Jersey City	750,000	20	165	170

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 545
Wm. Henry White, New York City ... 551
Fred. Bredel, N. Y. City ... 547

CHEMISTS.

Durand Woodman, New York City ... 545

GAS AND WATER PIPES.

Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 545
Ohio Pipe Co., Columbus, Ohio ... 545
M. J. Drummond, New York City ... 545
R. D. Wood & Co., Phila., Pa. ... 550
Warren Foundry & Machine Co., New York City ... 545
Donaldson Iron Co., Emaus, Pa ... 545
Gilbert & Barker Mfg. Co., New York City ... 545

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills. ... 542
Bartlett, Hayward & Co., Baltimore, Md. ... 549
United Gas Improvement Co., Phila., Pa ... 541
Burdett Loomis, Hartford, Conn. ... 538
American Gas, Light and Heat Co., Phila., Pa. ... 538

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 551
Continental Iron Works, Greenpoint, L. I. ... 551
Delly & Fowler, Phila., Pa. ... 551
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 548
Stacey Mfg. Co., Cincinnati, Ohio ... 551
Bartlett, Hayward & Co., Baltimore, Md. ... 549
Morris, Tasker & Co., Limited, Phila., Pa. ... 549
Davis & Farnum Mfg Co., Waltham, Mass. ... 548
R. D. Wood & Co., Phila., Pa. ... 550
Bouton Foundry Co., Chicago, Ills. ... 551
Isbell-Porter Company, New York City ... 550
Fred. Bredel, N. Y. City ... 547
United Gas Improvement Co., Phila., Pa. ... 541
National Gas Light and Fuel Co., Chicago, Ills. ... 542
Berlin Iron Bridge Company, East Berlin, Conn. ... 538

INCLINED RETORTS.

Laclede Fire Brick Manuf'g Co., St. Louis, Mo. ... 499

GASHOLDER TANKS.

W. C. Whyte, New York City ... 542
J. P. Whittier, Brooklyn, N. Y. ... 543

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass. ... 538

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J. ... 546
B. Kreischer & Sons, New York City ... 546
Adam Weber, New York City ... 546
Laclede Fire Brick Manuf'g Co., St. Louis, Mo. ... 546
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y. ... 546
Borgner & O'Brien, Phila., Pa. ... 546
James Gardner, Jr., Pittsburgh, Pa. ... 546
Henry Maurer & Son, New York City ... 547
Chicago Retort and Fire Brick Co., Chicago, Ills. ... 546
Baltimore Retort and Fire Brick Co., Baltimore ... 546
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo. ... 546
Boston Fire Brick Works, Boston, Mass. ... 546

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 502
R. D. Wood & Co., Phila., Pa. ... 550
James R. Floyd & Sons, New York City ... 544

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md. ... 549
Fred. Bredel, New York City ... 547
Chicago Retort and Firebrick Co., Chicago, Ills. ... 546
J. H. Gautier & Co., Jersey City, N. J. ... 547
Adam Weber, New York City ... 536

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City ... 543
Fred. Bredel, N. Y. City ... 547
Friedrich Lux, London, England ... 536
Wilbraham Bros., Phila., Pa. ... 543

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City ... 550
Continental Iron Works, Brooklyn, N. Y. ... 537

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page, N. Y. City ... 558

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y. ... 546

GAS METERS.

John J. Griffin & Co., Phila., Pa. ... 554
American Meter Co., New York and Philadelphia ... 555
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa. ... 555
Helme & McIlhenny, Phila., Pa. ... 555
D. McDonald & Co. Albany, N. Y. ... 555
Nathaniel Tufts, Boston, Mass. ... 554
Maryland Meter and Manufacturing Co., Baltimore, Md. ... 554
Harris Bros. & Co., Philadelphia, Pa. ... 554

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind. ... 540
Isbell-Porter Company, New York City ... 550
Wilbraham Bros., Philadelphia, Pa. ... 543
Connelly Iron Sponge and Governor Co., New York City ... 543

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 553
Perkins & Co., New York City ... 552
Despard Coal Co., Baltimore, Md ... 553
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 553
Westmoreland Coal Company, Phila., Pa ... 553
J. & W. Wood, New York City ... 552

CANNEL COALS.

Perkins & Co., New York City ... 552
J. & W. Wood, New York City ... 552

ANTHRACITE COALS.

Coxe Bros. & Co., New York City ... 553

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio ... 552

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. ... 535
Chapman Valve Manufacturing Co., Boston, Mass. ... 535
R. D. Wood & Co., Phila., Pa. ... 550
The P. H. & F. M. Roots Co., Connersville, Ind. ... 540
Gilbert & Barker Mfg. Co., New York City ... 545

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa. ... 520
Clerk Gas Engine Co., Phila., Pa ... 553

ENGINES AND BOILERS.

Jarvis Engineering Co., Boston, Mass ... 543
Westinghouse Machine Co., Pittsburgh, Pa. ... 545

GAS LAMPS.

Fiske, Coleman & Company, Boston, Mass. ... 546

PURIFIER SCREENS.

John Cabot, New York City ... 536

GAS STOVES.

American Meter Co., New York and Philadelphia ... 539
The Goodwin Gas Stove and Meter Co., Phila. Pa ... 556
George M. Clark & Company, Chicago, Ills. ... 536
D. McDonald & Co., Albany, N. Y. ... 555
Maryland Meter and Manufacturing Co., Baltimore, Md. ... 554
Chicago Gas Stove Company, Chicago, Ills. ... 536
Dangler Stove and Mfg. Co., Cleveland, O. ... 537

BURNERS.

C. A. Gefrorer, Phila., Pa. ... 552
Moses G. Wilder, Phila., Pa. ... 535
H. W. Rappleye, Phila., Pa. ... 535

STREET LAMPS.

J. G. Miner, Morrisania New York City ... 535
Bartlett Street Lamp Mfg. Co., New York City ... 535

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City. ... 536

PURIFYING MATERIAL.

Connelly Iron Sponge and Governor Co., New York City ... 543
Friedrich Lux, London, England ... 536
Greenpoint Chemical Works, Brooklyn, N. Y. ... 543

COKE CRUSHER.

C. M. Keller, Columbus, Ind. ... 553

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City ... 551
Fort Wayne Electric Co., Fort Wayne, Ind. ... 544

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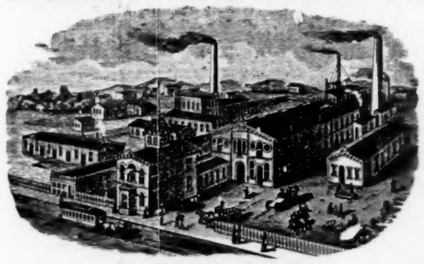

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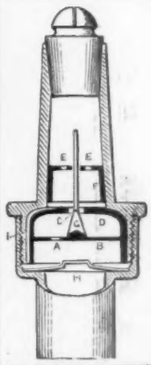

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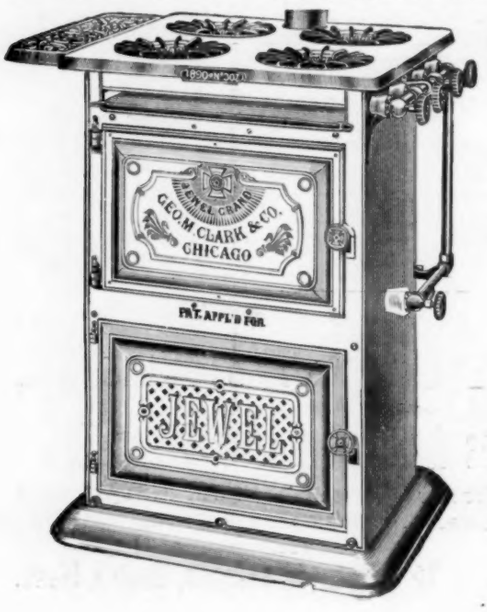

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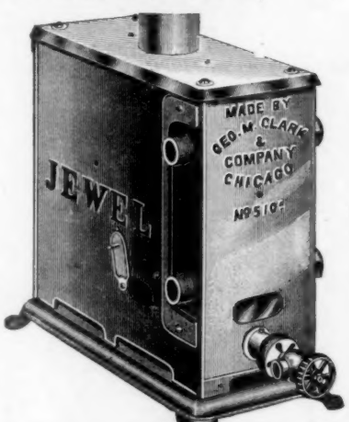

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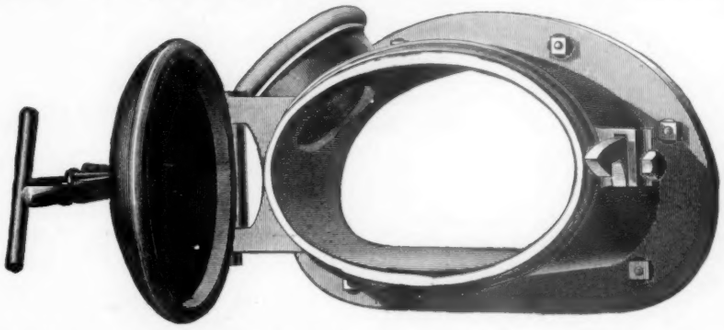

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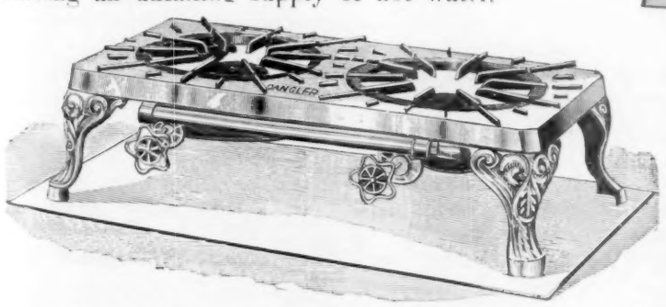

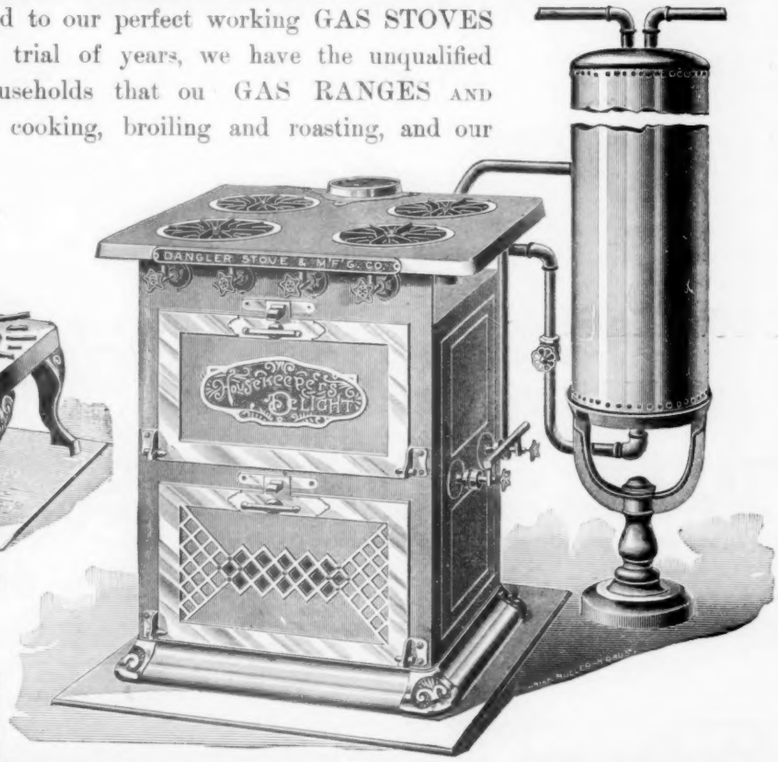

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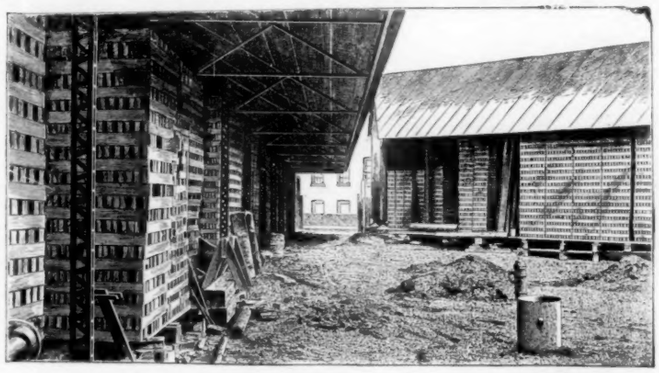

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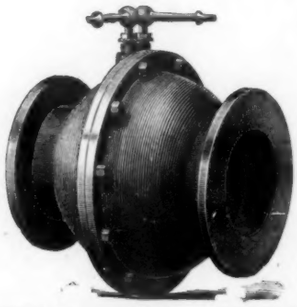

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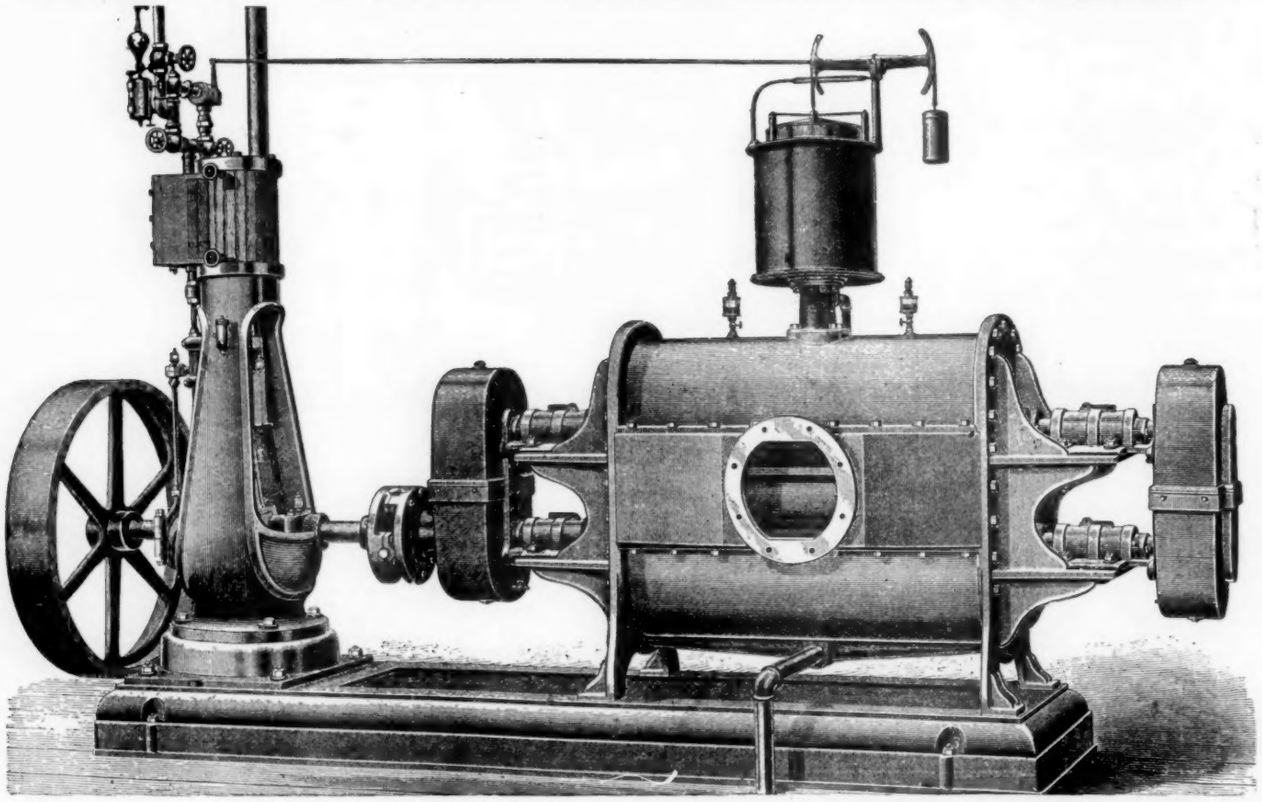

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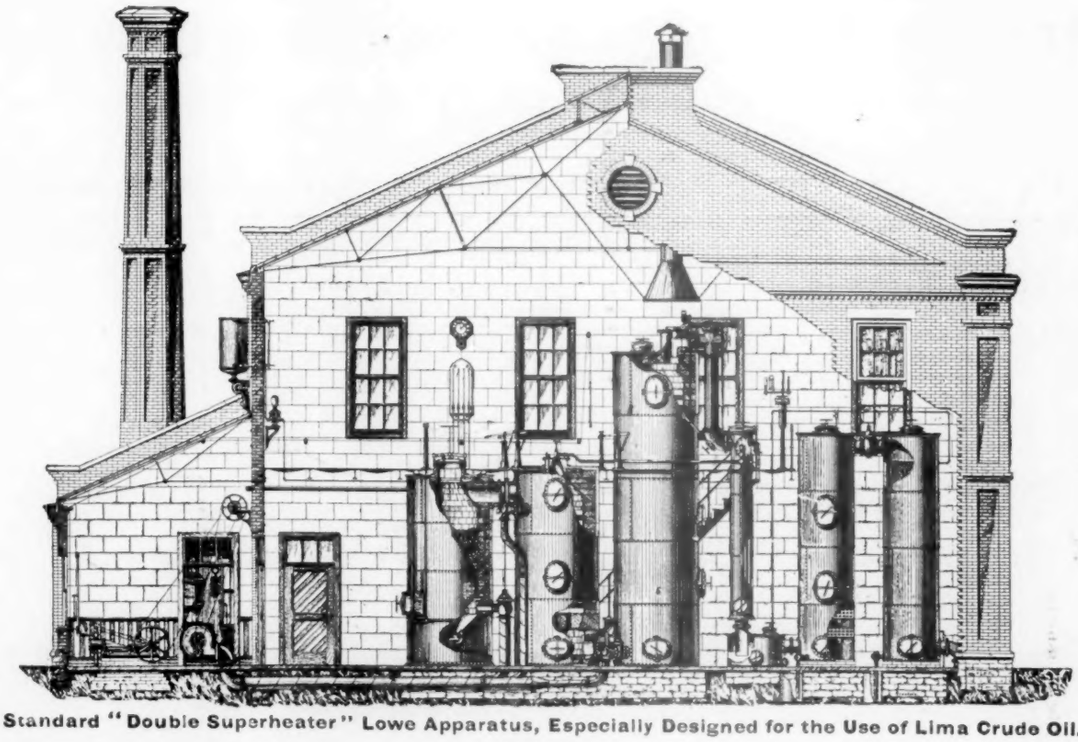

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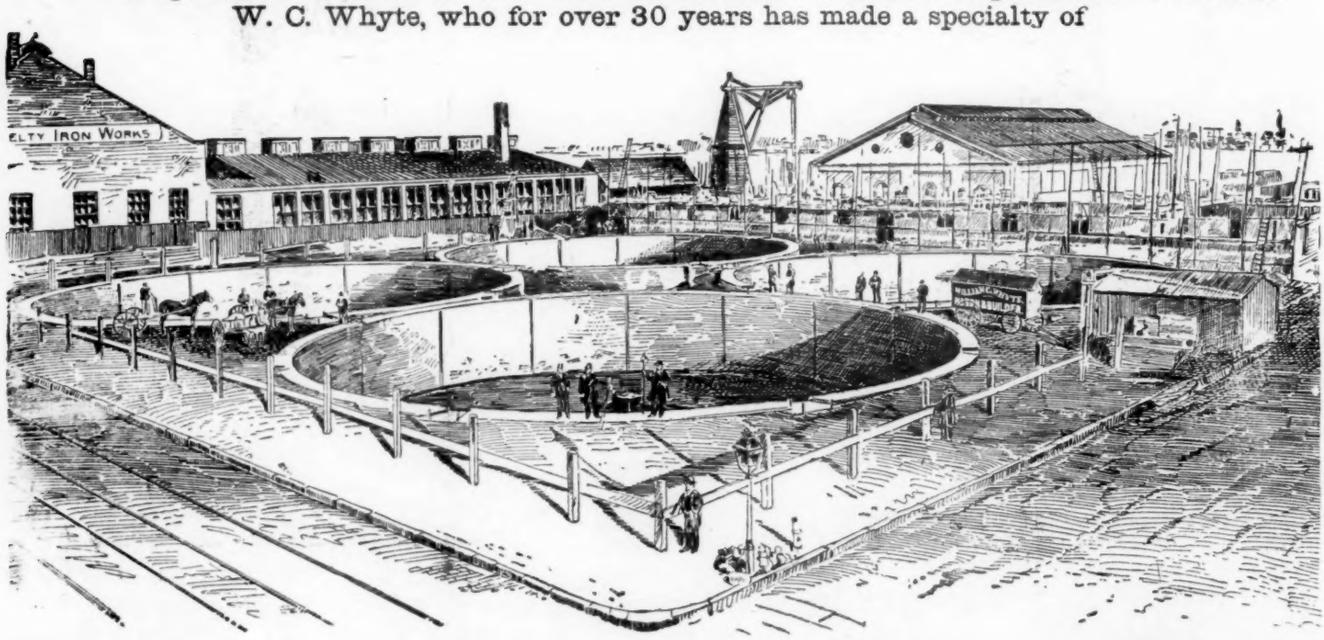

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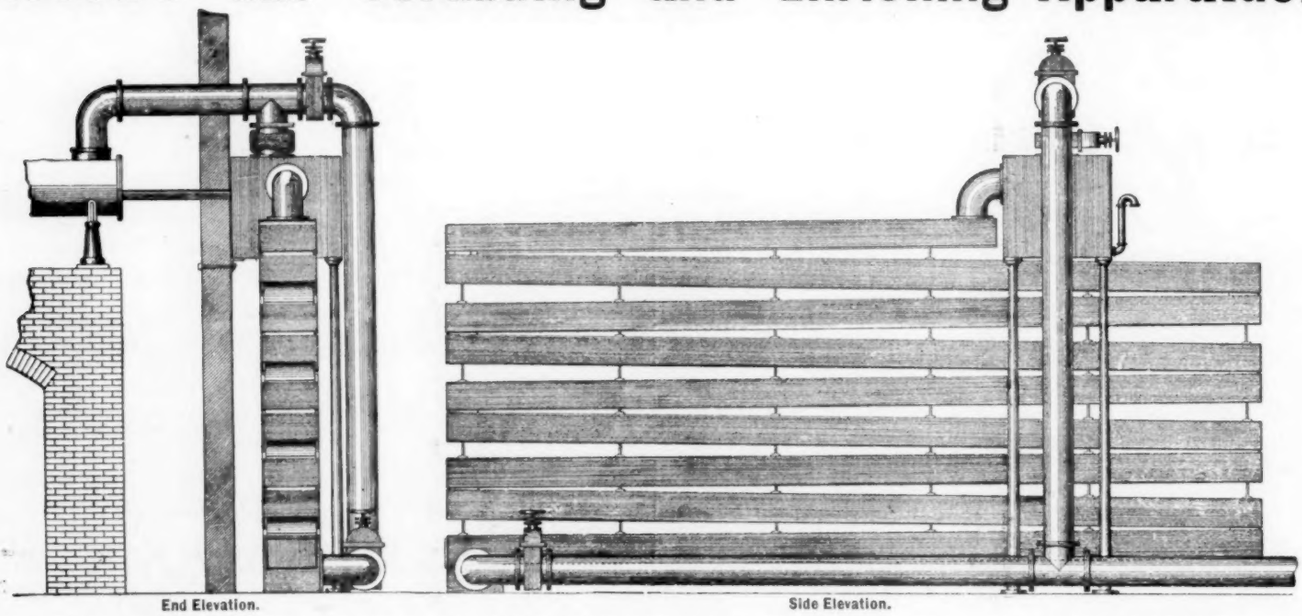

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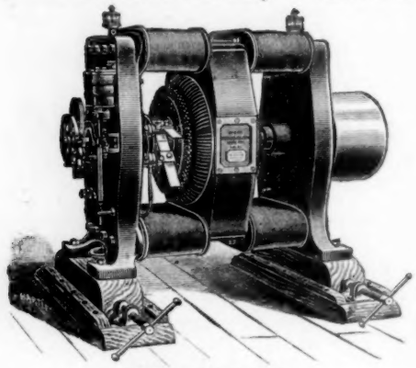

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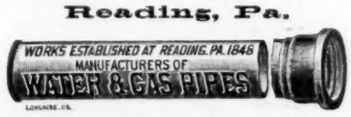

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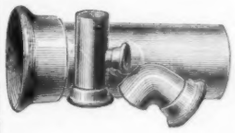

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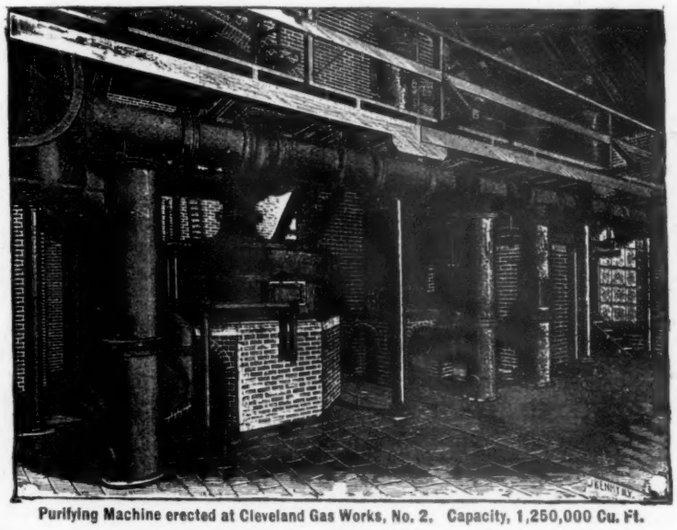

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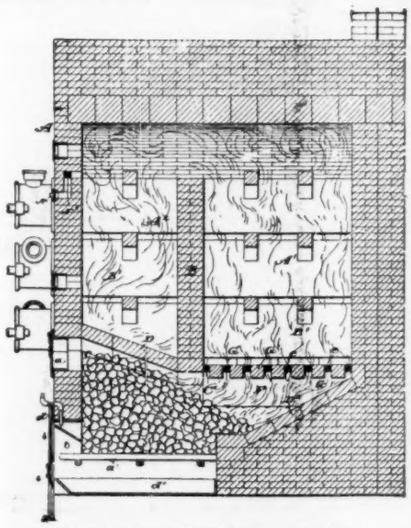

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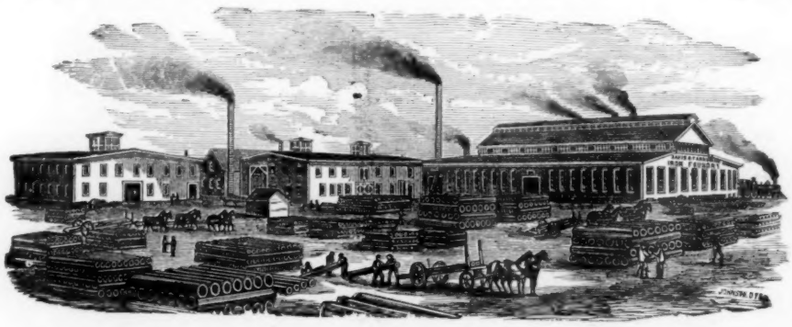

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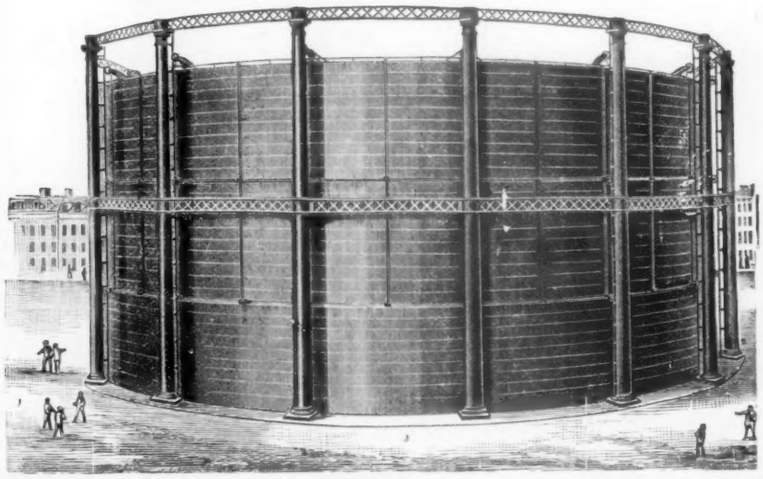

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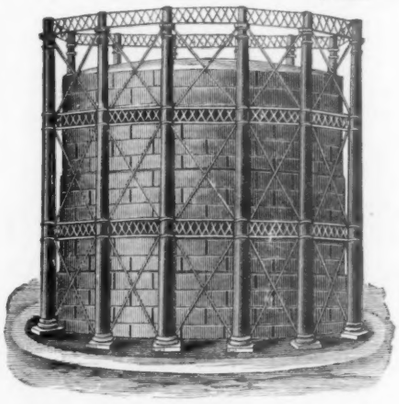

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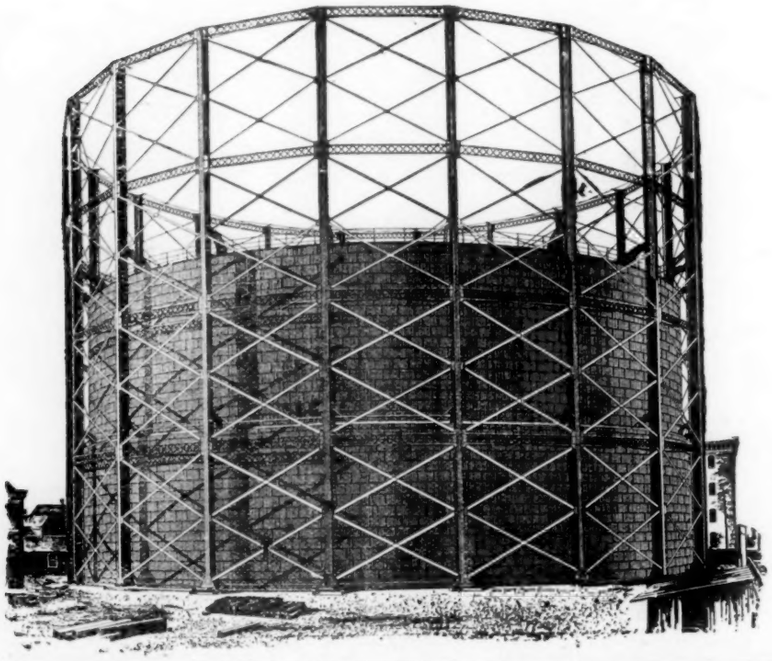

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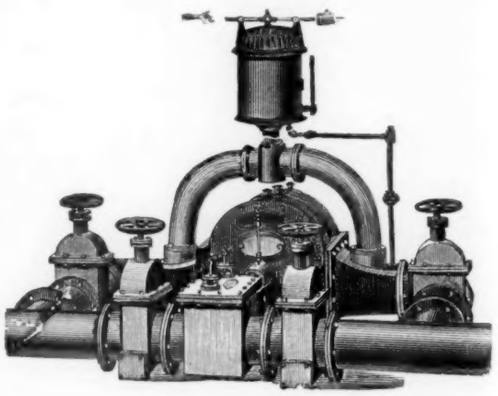

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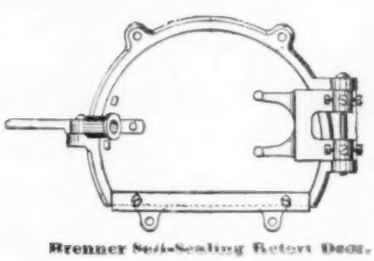

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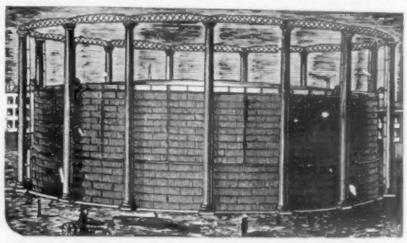
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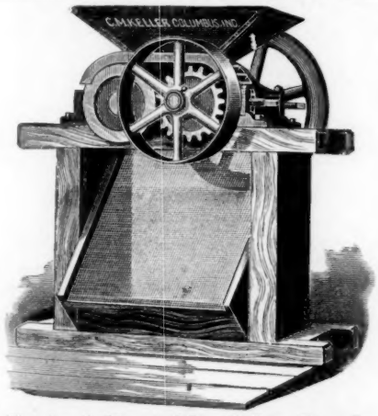

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The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in runn ng, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time

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The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

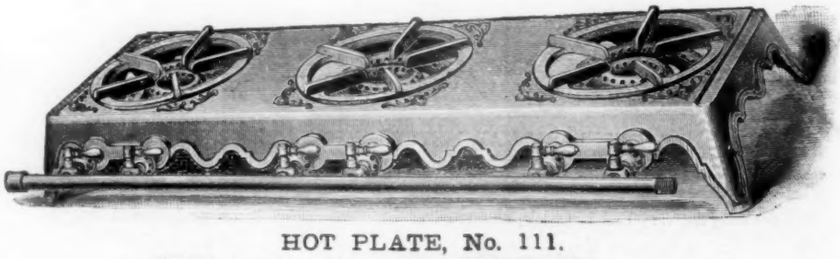
This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.



HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

[illegible] pipe should be used where the pressure is 1 in. or over.